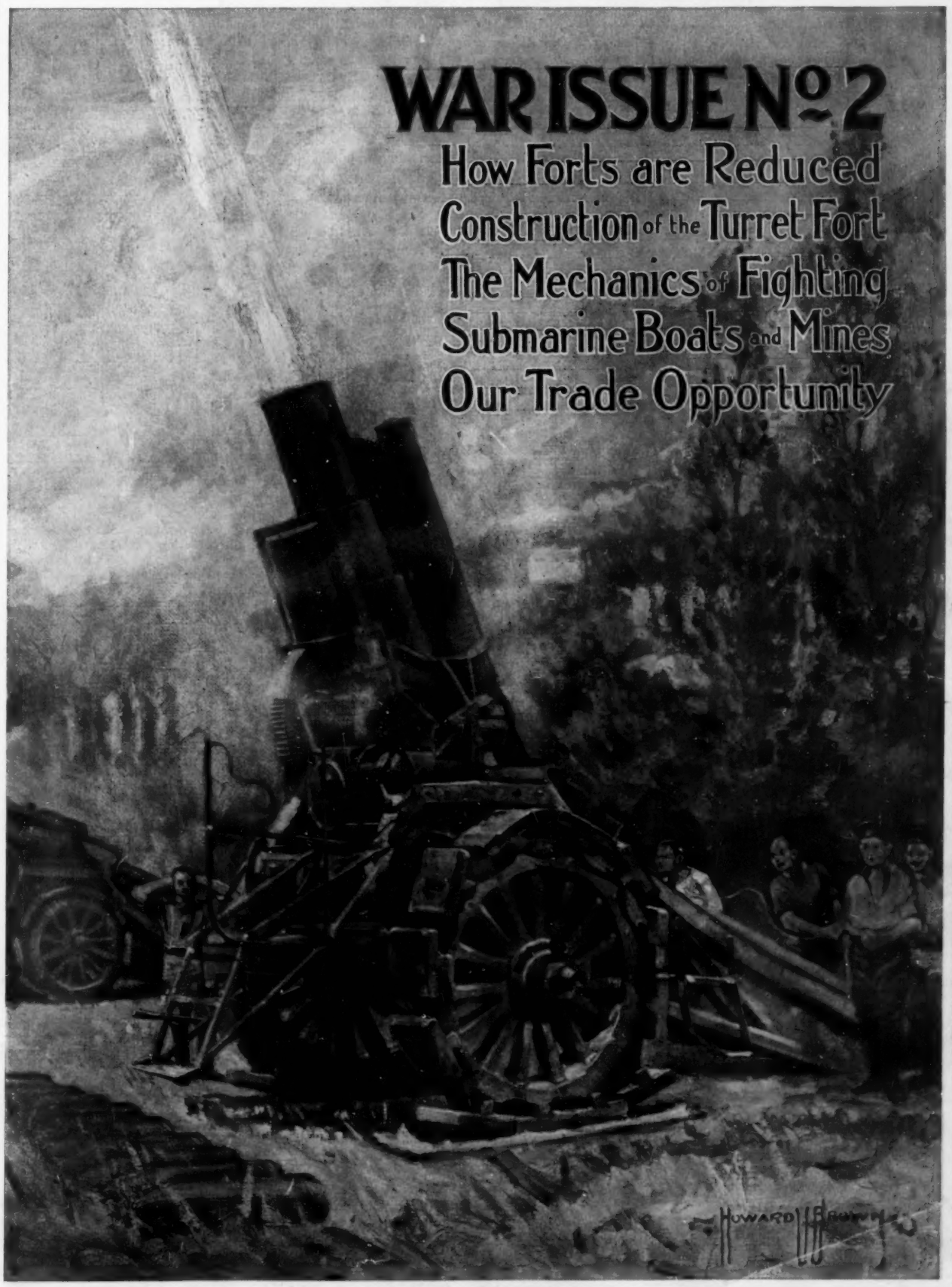
WITH SUPPLEMENT SHOWING GERMAN FLEET

SCIENTIFIC AMERICAN



Vol. CXI. No. 14
October 3, 1914

Munn & Co., Inc., Publishers
New York, N. Y.

Price 25 Cents
$3.00 A Year

Of Interest to All Who Plan to Spend $1000 to $2000 for an Automobile

We know that you want to get the best possible car for your money. No man consciously buys a cheap car.

So this advertisement is written to give you a few facts to keep in mind when investigating the merits of different cars.

For seven years Chalmers cars have ranked first among the medium priced cars in America. For two years Chalmers "Sixes" have led all medium priced Sixes in volume of sales. Over 40,000 Chalmers cars are now in service.

The Chalmers Company is recognized as one of the strongest companies financially in the industry. Chalmers cars have probably to a greater degree than any other make always influenced the trend of automobile building in the medium priced class.

Certainly these facts entitle this advertisement to a careful reading.

We expect you to investigate carefully every statement we make here and we urge you also to study all cars which sell between $1,000 and $2,000.

In the first place, we ask you to see the Chalmers "Light Six." Don't simply look at it and listen to the story of an enthusiastic Chalmers salesman, and then go look at another car and listen to the story of another equally enthusiastic salesman. You are not buying conversation.

But ask any Chalmers dealer to stand the Chal- mers "Light Six" alongside any Light Six selling at anywhere near its price—$1650. Study the cars yourself.

First—Looks. How do other cars compare with the Chalmers "Light Six" in style? The Chalmers has a ***real*** streamline body. The flat or merely crown fenders of the other cars have not the grace of the Chalmers molded oval fenders. Chalmers doors are wide and flush fitting. Chalmers running boards are clear.

And don't under-estimate this matter of looks. ***Half the pleasure of motoring is being proud of your car,*** and good looks really mean high quality.

Second—See which car is most substantially built. Thump on the body with your knuckles. The metal in the Chalmers body is heavy. It will never sound tin-panny. It is rigid. And because of these qualities its finish wears better.

Test the weight and solidity of the fenders. You can sit on the Chalmers fender and not injure it. It does not vibrate, and after months of strenuous use it does not rattle.

Looks and stability are two of the big reasons why we have been behind on orders for the 1915 "Light Six" ever since it was announced.

Sit in the front seat. Take hold of the gear shift lever and emergency brake lever. They feel strong and dependable.

And while you are in the front seat, test the comfort of the driver. You sit in a natural, easy position. The clutch and brake pedals are easy to reach. Your hands rest comfortably on the steering wheel. Put your foot on the accelerator. You do not have to assume a cramped position, but can operate it easily. ***The Chalmers accelerator is provided with a foot rest. Hundreds of owners of other cars have told us that this detail alone is worth $100 extra cost in a season's driving.*** Now sit in the back seat. Test its roominess and comfort.

In comfort, the Chalmers "Light Six" is the equal of any car of its size at any price. Many former owners of higher priced cars now drive Chalmers "Light Sixes"—and they all say ***comfort was a big factor in their selection of the Chalmers.***

Remember you are buying a car to ride in. You are not always going to drive on asphalt pavement. You are not going to use your car simply for thirty minutes or for five miles. But you are going to ride practically every day for two or three or possibly five years in the car you buy. You are going to travel thousands of miles and over all kinds of roads.

So don't take a mere "demonstration" in any car. Demand a test. Any Chalmers dealer will be glad to take you for a twenty-five or thirty mile trip in the country. He will give you a real test lasting two or three hours—or a day if you choose. Demand this same test of any other car.

And compare what the salesman tells you while you are riding with your own experience. Think about the comfort of the car. Ask yourself if you would be willing to ride twenty thousand miles in that car.

Note how the Chalmers "Light Six" clings to the road. Preferably drive it yourself.

The Chalmers "Light Six" has a big substantial steering wheel. The steering connections are heavy, free moving forgings. The front steering spindles are equipped with Timken bearings. It is free from side sway and easy to steer.

Many "Light Six" owners tell us this 1915 Chal- mers "handles" easier than any other car on the market. That feature alone has sold hundreds.

And notice too the sound of the motor as you ride along. Notice when you start that the first speed gears don't shriek out the fact that you are in motion.

Ask the demonstrator to drive twenty miles an hour on second speed. Note that both motor and gears are quiet. Pick out some hill and ask the Chalmers "Light Six" and any other car in its price class to go up that hill at fifteen miles an hour.

That long, strong pull of the Chalmers motor has proved one of its most popular features with the motor-wise.

On a rough stretch of road notice that the Chal- mers feels firm and dependable beneath you and is free of rattles.

The Chalmers medium weight makes it ride like a Pullman car on all ordinary roads. When you drive a Chalmers "Light Six" you feel that your car has the strength to be safe in any emergency. Your own ease of body and mind tells you that its medium weight gives it a comfort that cannot be found in a lighter or flimsy car.

We could build the Chalmers "Light Six" lighter in weight. And if our service to you ended with delivering a car and taking your money, we could make a greater profit by building our cars lighter. For every additional pound of fine steel we put into the Chalmers "Light Six" increases its manufacturing cost.

You hear a lot of talk about flexibility but very few cars really have it. The real test of flexibility is to start from a standstill in high speed without jerking or jolting; to crawl along at two miles an hour on high; to travel through congested traffic without gear shifting.

All these things you can do in a Chalmers "Light Six."

And when you get back from your test ride, take a look at some of the vital parts of the Chalmers chassis.

Look at the rear axle. The Chalmers has a full floating rear axle with heavy pressed steel housing. It is big and strong. Look at the Chalmers torque tube. It is securely bolted to the big heavy frame on one end and the rear axle on the other end. ***It takes up all the strains of driving.*** When you were out on the country road you probably noticed that the Chalmers "Light Six" did not sway from side to side. This is because the torque tube held it rigidly in place.

Look at the wheels. The wheels of the Chalmers "Light Six" have spokes 1¼ inches in diameter. They are built of the best hickory. The spokes are securely bolted. ***They look strong and they are strong.***

Notice the length and width of the Chalmers springs. The main leaf is of Vanadium steel. Note their flexibility—remember how they cradled the car over the bumps when you were riding on the heavy country roads.

Look at the front axle. You will see that the Chalmers "Light Six" has a heavy drop forged front axle that shows its strength at a glance.

Lift the bonnet and look at the motor. It is ship-shape, finely finished, compact and business-like in appearance. Raise the floor boards and examine the inside works that you don't usually see in a motor car. You will find the Chalmers "Light Six" simple in every detail but big and strong to stand the hard knocks of constant service.

Now for the details—the refinements which make motoring a real pleasure or a constant irritation.

To start the Chalmers "Light Six" you throw a single switch. There is no grinding of gears, no noise. You throw the switch and the next thing you hear the motor purring along under its own power.

Note too that the Chalmers starter is always con- nected with the motor when the car is running. Suppose you accidentally shut off the gas: ***your Chalmers motor doesn't stall.*** The starter is always "on the job." There is no interruption of motor service. No levers, buttons or adjustments to fuss with.

You sit behind the wheel of the Chalmers "Light Six" and everything necessary for the control of the car is right in front of you. There is a dash adjustment for the carburetor. There is a simple electric light switch, not a row of buttons to be remembered and to be operated separately; simply a single switch that controls all of your lights. There is the battery index to keep you always informed on the condition of your storage battery. There is the oil pressure gauge that tells if your motor needs oil. There is the primer for starting in cold weather. There is the gasoline gauge always informing you without fuss of the amount of fuel in the tank.

And speaking of gasoline tanks—notice that the tank in the Chalmers "Light Six" is of very heavy gauge steel. And that it holds 18 gallons where most cars carry ten or twelve.

The perfect convenience of the "Light Six" is one big reason this is the fastest selling Chalmers model—with women as well as with men.

Notice the adjustment of the windshield. The one-man top, the quick acting storm curtains, the fine and inconspicuous door handles.

And now you are ready to hear a talk on "econ- omy." Some salesman will probably tell you that his car is lighter than the Chalmers "Light Six"—that it doesn't burn as much gasoline; that it is easier on tires.

A part of what he says is true. But only a part; for a lot of this talk on gasoline consumption is just "conversation." Don't test your gasoline consumption for 1 mile or 10 miles—don't test it on the boulevard or with special gasoline. Try it out for 50 or 60 miles over all kinds of roads.

The Chalmers "Light Six" may cost you $10 or $15 or more for gasoline in 10,000 miles of driving than a too light, flimsy car, but it will cost you a lot less in repairs, in personal discomfort, in nerve irritation. You will find that the extra weight of the Chalmers "Light Six" will save you in comfort and repair bills many times the slight additional cost of the gasoline you burn.

What the other salesman tells you about tire mileage is probably greatly exaggerated because of his own ignorance. You will notice that ***the Chalmers "Light Six" has 4½ inch tires with "Nobby" treads on the rear wheels,*** where most other Light Sixes in its price class have 4 inch tires.

We have never had a complaint on tire service from a Chalmers "Light Six" owner.

You'll also hear something about prices. You'll be told that you don't need to pay $1650 to get a "light six."

Well, you don't. But if you pay less than the Chalmers price, you must expect to get less quality.

And speaking of price, here's the only sane way to look at it.

Divide the first cost of your car by five.

Automobiles that are properly built should last at least five years. That is, they should "stay put"—run well and give good service for that time. So when you examine a car in the future and are told how much less it costs than a Chalmers "Light Six," ask yourself, "Will it last me five years?"

Figuring any car you are considering on a five year basis, see if the facts above don't prove the Chalmers "Light Six" the lowest priced car, quality considered, on the market.

Yes, you are right—we want to sell you a Chal- mers. But we don't ask you to buy until you have proved all the claims we make in this advertisement. The only way for you to get such proofs is to see the car itself. You will be under no obligation if you go to see the 1915 "Light Six" and try it out, and you owe it to yourself to know all about this car before you buy any. All we ask is that you give your local Chalmers dealers the opportunity to demonstrate in detail the points of superiority of the Chalmers "Light Six" that we have told you about here.

Chalmers Motor Co., Detroit

CHALMERS · MOTOR · CO · Detroit, Mich. U.S.A.

Quality First

"Light Six" **$1650** ***Fully Equipped***

6-Passenger Touring Car, $1725 **Coupelet, $1900**
7-Passenger Limousine, $3200 **Sedan, $2750**

Prices Quoted f. o. b. Detroit

CHALMERS · MOTOR · CO · Detroit, Mich. U.S.A.

Quality First

$930,000 Per Week Paid for HUDSON Cars

$235,600 Paid by Users in One Day

On September 15—the day before this is written—dealers sold to users 152 HUDSON Six-40's. That is, yesterday buyers of new cars paid out $235,600 for HUDSONS.

The average has long been $930,000 per week—because that is the limit of output. We are building and selling 100 per day. That is five times as many—*five times, mark you*—as we sold at this season last year. And we had no war then. Our average sales have more than trebled since August 1st.

Means That Hudsons Rule This Field

In July—when we brought out this new model—we trebled our output to cope with demand. Thirty days later—despite our best efforts—we were 4,000 cars oversold.

We shipped by *express* nearly 1,000 cars to minimize delays. That is unprecedented. But thousands of men waited weeks for this car when other cars were plentiful. No other could satisfy men who once saw this new-model Hudson Six-40.

Five-Fold Increase An Amazing Thing

Consider that the HUDSON has long been a leading car. Every model for years has been designed by Howard E. Coffin. He has brought out in these cars all his new advances. And the demand for his models—long before this Six-40—gave HUDSONS the lead. The first HUDSON Six, inside of one year, made us the largest builders of six-cylinder cars in the world.

Think what a car this must be—this new HUDSON Six-40—to multiply this popularity by five in one year. And to do it at a time like this. Think how far it must outrank all the cars that compete with it. Think what a tremendous appeal it must make to car buyers.

Think how it attracts—how it must excel—when in times like these they pay $930,000 per week for it. And they would have paid more had we had the cars to deliver—as shown by yesterday's sales of 152 cars.

The Hudson Six-40 is today the largest-selling car in the world with a price above $1,200.

See the Car That Did It Howard E. Coffin's Best

Go now and see this model—the car whose record is unmatched in the annals of this line. You will see a quality car sold at a price which is winning men by the thousands from lower-grade cars.

You will see a class car—in many respects the finest car of the day—sold at one-third what class cars used to cost.

You will see how clever designing and costly materials have saved about 1,000 pounds in weight. And in this light car—the lightest seven-seat car—you will see one of the sturdiest cars ever built. You will see a new-type motor which has cut down operative cost about 30 per cent.

You will see new beauties, new ideas in equipment, new comforts, new conveniences. You will see scores of attractions you have never seen before.

They are all in this masterpiece of Howard E. Coffin, who has long been the leading American designer. This is his finished ideal of a car, and many count him final authority.

Mr. Coffin has worked for four years on this model, with 47 other HUDSON engineers. Part by part, they have refined to the limit every detail of the car.

This is the acceptable proven type. This lightness, beauty, economy and price are new-day standards which men are demanding. And this quality—Howard E. Coffin's level best—is the least men will take when they know.

Now is the Time

Now is the time to pick out your new car. Next year's models are out now. You see what the field has to offer. And the best touring months are before you—the Indian Summer days. Get your new car and enjoy them.

If you buy a class car, this new HUDSON Six-40 is the car you'll want. The exclusive features which have won so much favor are bound to appeal to you. Your dealer will see that you get your car promptly if we have to ship by express.

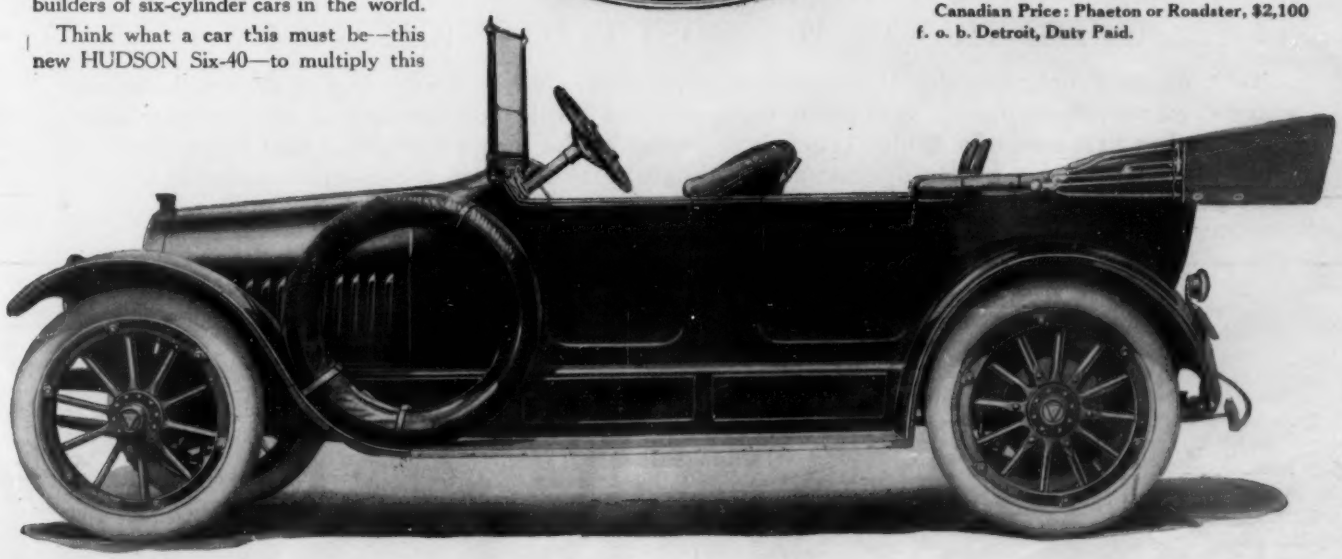
Five New-Style Bodies:

7-Passenger Phaeton	$1,550
3-Passenger Roadster	$1,550
3-Passenger Cabriolet	$1,750
4-Passenger Coupe	$2,150
Luxurious Limousine	$2,550

All f. o. b. Detroit

Canadian Price: Phaeton or Roadster, $2,100 f. o. b. Detroit, Duty Paid.

Six-40
HUDSON
$1,550



HUDSON MOTOR CAR COMPANY, 8247 Jefferson Ave., Detroit, Mich.

SEVENTIETH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXI.]
NUMBER 14.]

NEW YORK, OCTOBER 3, 1914

[25 CENTS A COPY
$3.00 A YEAR

Photo. by International News Service.

Louvain, after burning by the Germans.

Photo. by International News Service.

Captured French and Belgian guns hauled through the Unter den Linden, Berlin. On the Brandenburger Thor, seen in the background, is a bronze group brought back from Paris in 1871.

SCIENTIFIC AMERICAN

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Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Frontiers in the Old World and the New

IF they were not so deeply engrossed, just now, in the work of mutual butchery, we would invite the warring nations of the continent of Europe to contemplate the following very significant facts:

First, that here, on the continent of America, the two greatest nations of the world have a common frontier, which extends, unbroken, for some four thousand miles.

Second, that throughout the whole vast reach of it there is not to be found, on either side, a single fortification, or any offensive or defensive military work of any kind whatsoever.

Third, that leading up to, crossing it, or running parallel with this frontier, there does not exist a single so-called military railway—every line of railway communication having been built with a single eye to the development of the natural resources of the two countries, and the mutual exchange of the products of peaceful industry.

Fourth, that in spite of the fact that this far-flung frontier was the eventual outcome of a fierce and bloody war, and that these two powerful nations have always been engaged in keen commercial rivalry, they have been content to leave their frontiers in this totally undefended condition, and have lived as perfectly amicable neighbors for the past one hundred years.

Except for the slight custom house delay at the border, there is absolutely nothing that suggests to the traveler, be he British or American, that he has crossed the line which marks his transit from his own to a foreign country.

But let the American take ship to Europe and commence his travels of leisure and curiosity. Everywhere he finds the frontier lines emphasized by enormous forts, which are themselves interconnected by chains of lesser redoubts and intrenchments, the whole work being insistent and obtrusive, and presenting a forbidding aspect of antagonism and defiance. Nowhere at the frontiers will he see the signs or hear the notes of welcome—everywhere his eye will catch the glint of the bayonet, or his ear will note the call of the bugle and the tramp of armed men.

Furthermore, a study of the railway map of Europe reveals the fact that other considerations than those of industry and commerce have determined the direction and the grouping of the railroads of central and western Europe. It is a fact, well understood, even outside of the war colleges of Europe, that military necessities have received the first consideration in the laying out of the railroad systems that have been built since the days of Bismarck and the formation of the German empire. When railroads radiate by the score to the frontier of a so-called friendly state, and when for all purposes of commerce they seem to end there, their meaning is plain. Taken together with the frowning forts which sit astride their most important junctions and meeting places, they constitute a permanent menace to the friendly state across the border, and they serve to smother, even at its very birth, any growth of that spirit of "peace on earth, good will toward men," of which the four thousand miles of undefended frontier on the Canadian border, and the one hundred years of unbroken peace between the United States and Great Britain, give such a noble and enduring expression.

That heavily fortified frontiers, backed up by a network of military railways, are a menace to a friendly neighboring state, and provocative of responsive military works, and that they produce an atmosphere of international suspicion and dislike, cannot be disputed. The turning of Germany into an armed camp, with its frontier fortifications as the outworks, may have been a policy pacific and purely defensive in intent; but its effect on the neighboring states has been the reverse of pacific.

We happen to have before us that illuminating work by Gen. Kouropatkin, the commander-in-chief of the Russian army in Manchuria, entitled "The Russian Army and the Japanese War." After a brief survey of the several wars of Russia and the gradual expansion of her empire, he writes: "'Russia is in no need of any further increase of territory. This conclusion is in the highest degree important and satisfactory. At the same time, our military position does not now compare so favorably as formerly with that of our neighbors, principally owing to our lack of railways; and our western frontiers are exposed to great danger through the perfect state of preparation of Germany and Austria." Later in the same chapter, speaking of the growth of the Russian army keeping pace with the growth of population, he writes: "Our maximum in the Prussian war, 1756-62, was only 130,000 (troops). I am thankful to say we have lived at peace with our western neighbor for 150 years." After pointing out that Germany has a network of military railways leading to the Russian border, as against five Russian railways, he concludes: "Thus the chief duty of the War Department in the first years of the present century is the defense of our frontiers. Of these, our Austrian and German borders, being the most dangerous, should receive our particular attention."

This was written in 1909. Since that time Russia had planned and was constructing a system of defensive railroads to meet the emergency; and it was the determination of the German-Austrian alliance to strike before Russia could complete this great work, that formed one of the strongest motives for the precipitation by the Dual Alliance, in the present year, of the long-intended and carefully prepared for conflict.

There is a growing conviction that if the Teutonic attempt to establish that military dictatorship of Europe which was the ill-fated dream of Napoleon, results in failure, there will follow, if not the complete overthrow, at least the final subjugation and control of militarism. Of the many guarantees of this desirable result, we can think of none that would be more effective than the complete obliteration of those fortifications, modern in construction, but essentially medieval in conception, which menace and disfigure the frontier lines of the great European states.

Military Meteorology

AN American army officer—an instructor in the Army Service Schools at Fort Leavenworth—has written to the New York *Times* complaining that the press reports of the great conflict now in progress in Europe usually give no information as to weather conditions, "which have everything to do with military operations." He adds: "To the army officers among your subscribers the daily temperature, rainfall, direction and velocity of the wind, in all parts of the theater of war, are of an importance and interest surpassing columns of the material you give regarding skirmishes, reconnaissances, etc. These data are also extremely difficult to get after the occurrence, and your paper would become of permanent historical value if it gave these, if for no other reason."

It is true that the weather has occasionally cropped up in the war news, though so casually and modestly that its immense importance in shaping the course of events has been, apparently, quite lost sight of. Thus we gather that a dense fog greatly hastened the fall of Namur, by enabling the Germans to place their siege guns in an advantageous position without danger to themselves. The persistent drenching rains that fell during the long battle of the Aisne must have so impeded the movements of artillery, as well as other operations, as to modify materially the strategy of the commanders, though details on this subject are still lacking. The oppressive heat of the early days of the war in Belgium is also a matter of record. These bits of information have been, however, quite exceptional; as a rule the weather has been altogether ignored by the correspondents.

Turn the pages of history and you will find that weather has always been a factor of prime importance in the conduct of war, playing a rôle analogous to, and co-ordinate with, that of topography, though, strange to say, military writers usually exaggerate the relative importance of the latter. It would be easy to compile a long list of battles in which the weather has actually been the *decisive* factor. Take the effects of rain alone: Heavy downpours and resulting floods led to the total destruction of the three Roman legions under Varus, in A.D. 9. Fifteen hundred years later persistent rains saved Vienna from capture and destruction by the Turks. In 1692 an English army was prevented by heavy rains from crossing the Mehaigne to relieve Namur, then besieged by the French, and the city fell. It would, however, be tedious to enumerate all the instances under this head.

The progress of military science has by no means rendered armies less susceptible to the effects of the elements. If the introduction of motor vehicles has facilitated the transportation of artillery, so has the use of heavy guns in the field increased, and muddy roads remain a serious obstacle. The deadliness of modern ordnance, as well as the use of searchlights and aeronautical fire-control, make it imperative to keep troops under cover to a far greater extent than was once the case; but a fog, or even heavy rain or snow, furnishes an ideal cover which does not entail immobility. Besides these and other physical effects of the weather upon military operations, the physiological and psychological effects of weather upon fighting men are still much the same as they were a thousand years ago.

It is evident that the modern commander must reckon with the weather in making his plans. If a body of troops is to be moved from one point to another, a heavy rain may make a difference of hours or days in the time required for this movement. An aerial reconnaissance, most desirable at a certain juncture, may be prevented by violent winds. A body of water, that today offers an impassable barrier to the enemy, may be to-morrow a practicable highway of ice. And so on.

A corollary to these considerations is the fact that it behooves military men to possess a knowledge of meteorology, and thus to be able to foresee changes in the weather, so that they may shape their strategy accordingly. It has, in fact, been recently suggested by an Austrian military expert that a competent meteorologist ought to be attached to the headquarters of every army. When the history of the present European conflict is written, it will be interesting to see what part scientific weather prediction has played therein. It is a safe guess that the Germans, at least, have already realized the possibilities of military meteorology and are utilizing this inchoate branch of applied science.

What Business Men Think of Our Trade Opportunity

WE have heard so much of the opportunity that beckons the American manufacturer and merchant in foreign markets, now that all Europe is embroiled in war, that it occurred to the Editors of the SCIENTIFIC AMERICAN to obtain from our representative business men their views on the possibility of expanding our export trade. Accordingly, we addressed a letter of inquiry to officers of those corporations whose activities had already made them acquainted with foreign trade and foreign business methods, and who were, therefore, in a position to give something like expert advice. The result is a collection of opinions which appears elsewhere in this issue.

After we had read these admirable presentations of competent authorities, we were impressed with the fact that our more prominent manufacturers regard our foreign opportunity not as a small boy contemplates an unguarded apple orchard, but as a great commercial problem which must be thoroughly studied before it can be attacked with success. With one or two exceptions, the letters are distinctly optimistic in tone. The writers, for the most part, realize that Germany and England have been successful in foreign markets because they have ascertained the needs of those whom they wish to serve, and because they have established adequate banking facilities.

Indeed, the whole problem narrows down to a study of foreign market requirements and to the establishment of a credit system acceptable to foreign consumers of American goods. Considered thus, the problem is one with which we ought to be able to cope successfully. The scientific study of our home market began not more than a decade ago, and the establishment of an elastic home credit system, which would aid our business men in financial crises, dates back only a few weeks. If the same systematic study is conducted in foreign markets, if the same consideration is shown for the banking requirements of foreigners as for Americans, there can be no reason why we should not gain a permanent foothold in markets which have hitherto been closed to us.

What Tuberculosis Costs the Nation.—It has been estimated that deaths from tuberculosis cost the nation half a billion dollars annually through the loss of wages and the value of production, and to conquer this enemy of the human race more than $20,000,000 is being expended. That the good work is progressing is shown by the fact that in twenty years the death rate from tuberculosis has been reduced from 245.4 to 158 per 100,000 of population. This success has been made possible by the discovery of the germ of tuberculosis by Dr. Robert Koch, thirty-two years ago, thereby opening the way for a scientific fight against this the most deadly disease the human race has ever had to contend with.

Protection for the Fighting Line of an Army

Fortifications and Their Relation to the Operations of Armies in the Field

By Lieutenant-Colonel Leon S. Roudiez, United States Army

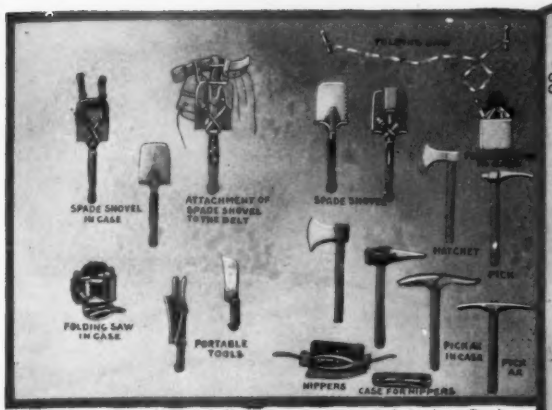


FIG. 1.—Tools of the Belgian Infantry. Each infantry company carries an equipment consisting of 100 Linnemann shovels, 12 billhooks, 6 jointed or folding saws, 1 rose nipper, 1 three-cornered file, 24 canvas buckets, 12 field lanterns.

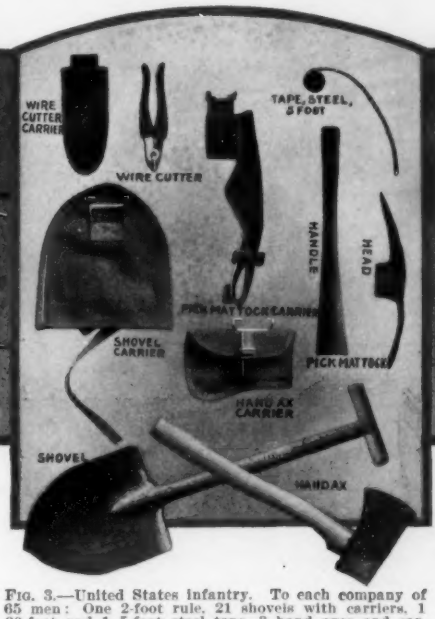


FIG. 3.—United States Infantry. To each company of 65 men: One 2-foot rule, 21 shovels with carriers, 1 60-foot and 1 5-foot steel tape, 3 hand axes and carriers, 7 pick-mattocks and carriers, and 9 wire cutters and carriers.

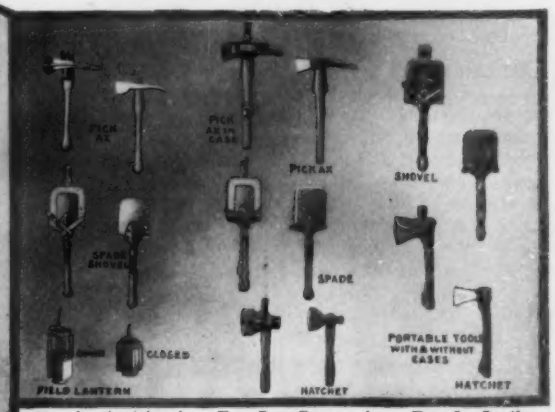


FIG. 4.—Austrian Infantry. Each company carries about 5 lanterns, 1 handsaw, 1 spade for every two men, and 1 pickax for every fifteen men.

FIG. 5.—German Infantry. The number of portable tools amounts to 115 to a company, as follows: 100 small spades, 10 pick hatchets, and 5 hatchets.

FIG. 6.—In the Dutch army each infantry company carries rifles, ammunition, 16 axes and 100 small shovels.

THE principal object of this article is to present in as simple a form as possible—free from technicalities—a general description of the various types of fortifications in use in modern warfare.

Offensive operations demand a high degree of mobility. This naturally suggests a careful consideration of the relation existing between fortifications and the mobility of an army in the field. The writer hopes that with the assistance of the accompanying illustrations, the non-military reader, for whom this is especially intended, may obtain a clearer idea than he had before of the uses and means of providing artificial cover and protection for the fighting lines of an army.

Fortifications may be divided into two classes, permanent fortifications and field fortifications. No attempt will be made to describe the former class any further than is absolutely necessary to point out the difference between that class and the one designated as "Field Fortifications," which is the real subject on this paper.

The Object of Fortifications.

Permanent fortifications consist of defensive works constructed by a nation to secure permanent possession of strategical positions of importance within the territory under its control. These would generally include national capitals, great commercial and railway centers, harbors, important bridges and mountain passes, great concentration camps and depots of supplies.

The decision as to whether or not a city shall be fortified depends first on its location, second, on its importance.

Many European cities are really large forts surrounded by one or more lines of smaller detached forts located at strategic points some distance, varying from 5 to 15 miles, from the walls of the city. Paris, Belfort, Strassburg are some of the many examples of this

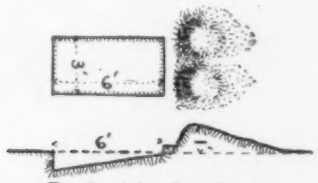


FIG. 9.—Lying down trench.

type. Other cities, like Liège, are surrounded by one or more lines of detached forts, while the city itself is practically open or unfortified.

Earth embankments, stone and concrete walls and steel shields and turrets enter into the construction of the modern permanent fortifications. They are built in time of peace, armed with the latest type of heavy guns, and are supposed to embody the best thoughts of the strategic and of the military engineer.

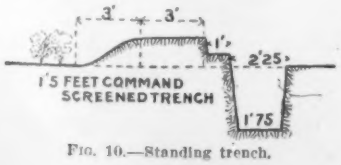


FIG. 10.—Standing trench.

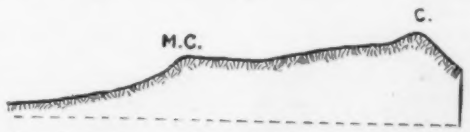


FIG. 7.—Profile of hill. Point M.C. is the "Military Crest," although it is not the highest point or crest of the hill.

The Big Gun is the Death Knell of Permanent Fortifications.

Our text books tell us that "a position protected by permanent fortifications and properly garrisoned should yield only after a protracted siege." This was quite true yesterday, but to-day the gunmaker is turning out a new portable howitzer of wonderful power which, if we can trust the contents of recent war bulletins, is sounding the death knell of the permanent fortifications of modern times.

Long before the advent of the 11-inch howitzer a number of military writers expressed strong doubts of

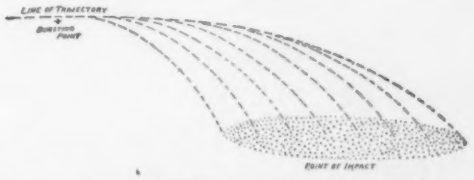


FIG. 8.—The ground covered by a shrapnel is elliptical in form and at the effective ranges does not exceed 200 yards in depth by 25 in width. Shrapnel is the most important projectile. The case is of drawn steel with solid base. The mouth of the case has an aluminium head screwed in and tapped to take a combination time and percussion fuse. The case contains 262 balls, each 0.49 inch in diameter. The bursting charge consists of 2¾ ounces of loose black powder; it is placed in the base, and covered by a steel diaphragm. The fuse is timed so that the case will burst just in front and above the trenches or line of troops.

the value of permanent fortifications as applied to large cities and great camps. They argued, and cited many instances in support, that a fortified city does not prevent an invasion of the national territory by a strong and numerous enemy who can well afford to detach a force sufficient to invest the fortified place and immobilize its defenders—compelling them to capitulate within a comparatively short time—while he proceeds with the main operations with the bulk of his troops.

An army in the field may meet with daily reverses, but, if skilfully handled, it can avoid disaster, and even if brushed aside by a much stronger force it can retain its mobility and thus continue to annoy the enemy and endanger his lines of communication. It continues to be a factor in the game. It cannot be ignored.

An army operating within its national territory may even cut loose from its fortified base of supplies, and falling back on its own country, procure its supplies from local sources, until a new base can be established. By keeping constantly in touch with the enemy this mobile army may have the opportunity of inflicting serious damage, if not defeat, on the invaders.

The Temptation Offered by Permanent Fortifications.

No such opportunities are opened to the commander who, in the face of reverses, allows himself to be tempted by the fancied security offered by permanent fortifications. He may deceive himself into believing that he is simply taking refuge within the fortifications for a few days in order to give his men a little much-needed rest or to replenish his supply of food or ammunition, and that he will soon again take the field better prepared to fight than ever before. But the chances are against him. When he thinks he is ready to take the field, he finds that the enemy has invested the place. If he is to get out, he must practically cut his way out. This would mean that most, if not all, his baggage and supply trains would probably be lost, or have to be left behind. He would then be a great deal worse off than before. As a matter of fact, when an army takes refuge behind permanent fortifications it seldom comes out again except as "prisoners of war." The moral effect of capitulation, even after a "heroic siege," is almost as serious as the loss of men and material.

It is not the intention to condemn all permanent fortifications. There are many cases where, in certain locations, fortifications will be found invaluable in preventing or delaying an invasion, but these should be of a type that clearly illustrate the principle on which the value of fortification is based, to wit: Greatly to increase the fighting power of troops occupying the position, by increasing the effect of the fire action of the troops protected by the fortification and to diminish the effect of the fire action of the assailant and limit his mobility, thus enabling a comparatively small garrison to resist the attacks of a greatly superior force successfully, and prevent its advance into the guarded territory.

FIG. 11.—Standing trench without screen, but with low parapet for better concealment.

Offensive Operations More Likely to be Successful.

It has been generally conceded that real success in war results only from offensive operations.

It is true that in order to gain time to complete the

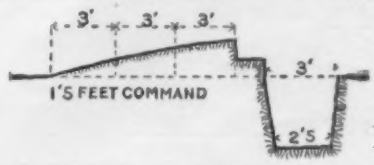


FIG. 12.—Standing trench, a little wider and with 6 inches more "command," i. e., the soldier stands so that his eyes can see over a parapet 18 inches higher than the natural level of the ground, instead of 12 inches, as in Fig. 11.

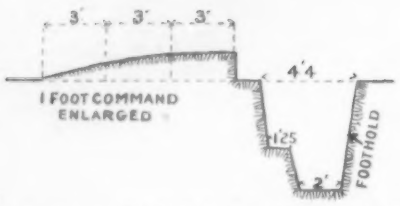


FIG. 13.—Same as Fig. 12, but enlarged to facilitate communication in the trench, behind the line of men firing over the parapet. The foothold is to assist the men in getting out of the trench.

mobilization of its troops, or for other reasons, a nation in danger of invasion by a more powerful or better prepared neighbor may be compelled to assume a defensive attitude. Its highly disciplined and efficient armies, skillfully handled, may be able to inflict tremendous losses on the invader by repeatedly compelling him to attack and carry strong defensive positions, previously prepared, in order to continue his advance into the defender's territory. The defenders, by a succession

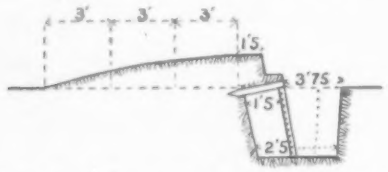


FIG. 14.—Same as Fig. 13, but with splinter-proof cover. This is for protection against shrapnel bullets.

of well timed and orderly retreats to selected positions in the rear, may succeed in drawing their more aggressive opponent into a position where all the advantages, strategic and tactical, will then be on the side of the defenders. All this, however, will result in little or no advantage to the defenders unless they are prepared

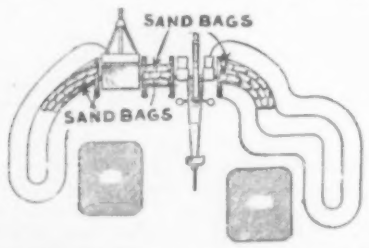
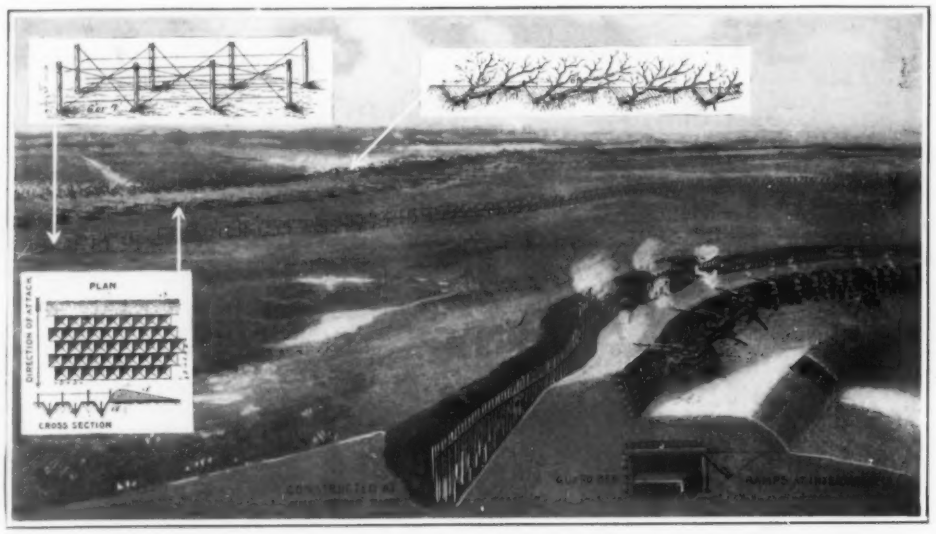


FIG. 16.—Hasty intrenchments for field artillery; protection against rifle fire and shrapnel.

and willing promptly to assume the offensive at the psychological moment, and thus turn the tables on the weakened enemy and drive him out of the country.

A protracted defensive is a dangerous game. Recent events show that a skillful commander can play it successfully against perhaps the best armies the world has ever seen. We are not yet in position to count the costs or to predict the ultimate results. At date of writing the counter offensive is meeting with success. This is in accord with the rules of the game.



The small inserts indicate the more usual types of obstacles employed in the defense of redoubts. The arrows indicate where they are to be found in the main picture.

Fig. 15.—Redoubt, showing types of field casements and bomb-proofs.

To elucidate: In connection with the disadvantages of a strictly defensive campaign, let us assume that the armies of a strong nation have invaded the territory of one of its neighbors. The latter, for reasons of its own, assumes a defensive attitude, and by a succession of skillfully-managed retreats within its own territory, during which it has been able to inflict severe losses on the enemy, it succeeds in drawing the invaders far from their base, and, as a result of the losses inflicted and of the dangers to which their lines of communication are exposed, the latter reach a point where they must halt for a while to recuperate or await reinforcements. Let us suppose that the defenders are then either unable or unwilling to assume the offensive. Military operations with the exception of unimportant clashes between advance guards and reconnoitering patrols, will practically come to a standstill for the time being.

Both combatants might be willing to make peace under certain conditions, but neither is in position to suggest it. The invaders cannot propose it because it would be taken as an indication that, while successful up to date, they fear for the future, and would be willing to quit while they have the advantage. As for the defenders, a proposition from them would be equal to acknowledging that they are hopelessly beaten. Therefore both await developments.

This, however, is the opportunity of the peacemakers especially the "peace at all cost" advocates. Considering the strong public sentiment against war in any form existing throughout the world to-day, several allied nations might decline to consider offers of mediation from neutral powers on the ground that the time had not yet arrived for such action; but no one nation would risk antagonizing public opinion by refusing to

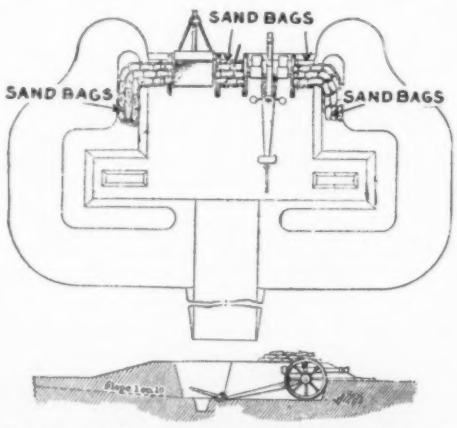


FIG. 17.—Deliberate intrenchments for field artillery when depression is necessary for concealment.

accept the good offices of neutral, friendly nations under the circumstances outlined in the foregoing situation. Therefore, we may assume that in response to friendly advances and representations, both belligerents agree to an armistice for the purpose of discussing peace preliminaries.

The military situation would then be about as follows: The invaders have not crushed the defenders, they have not captured any of their armies, or decisively defeated them, or caused any of their fortresses with their garrison to capitulate; neither have they captured their capital nor seriously interfered with their national government. But they have invaded the defender's territory and are occupying a more or less extensive portion of it in force, and are preparing to resume the offensive. The defenders on their side have retreated, it is true, but they have not been decisively defeated at any point. Their defensive operations have compelled the invaders entirely to change their original plan of campaign and to abandon strategic operations

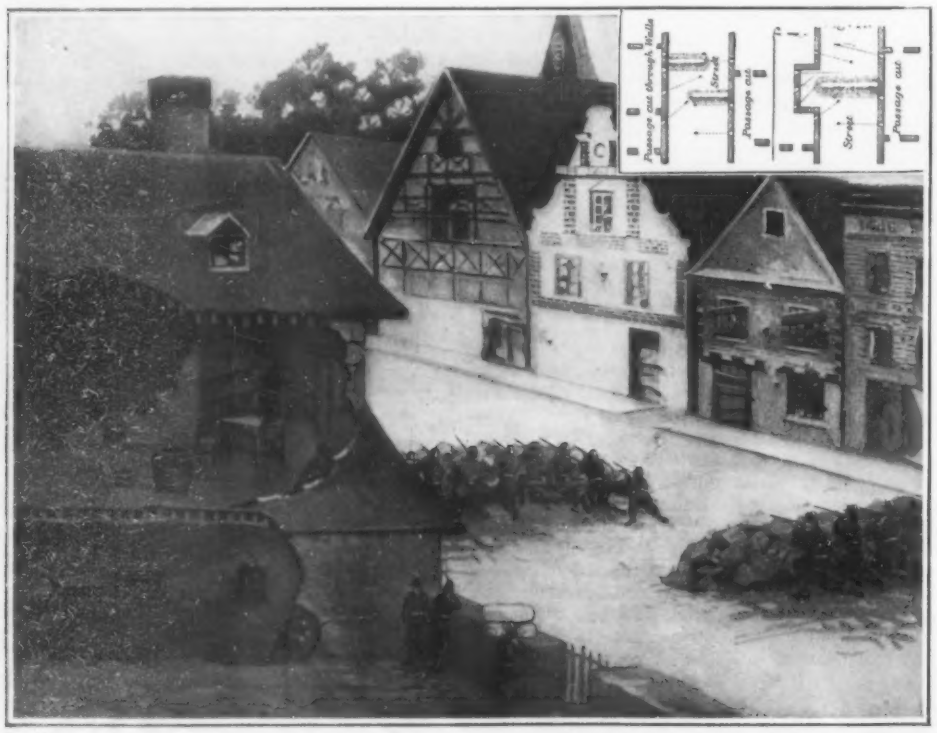


Fig. 18.—Street barricades, showing loopholes cut through walls.

Note also passageway cut through walls connecting the houses on each side. The deadly house-to-house fighting mentioned in battle reports, takes place along the line of these passages. The insert shows the general arrangement of such passages clearly.

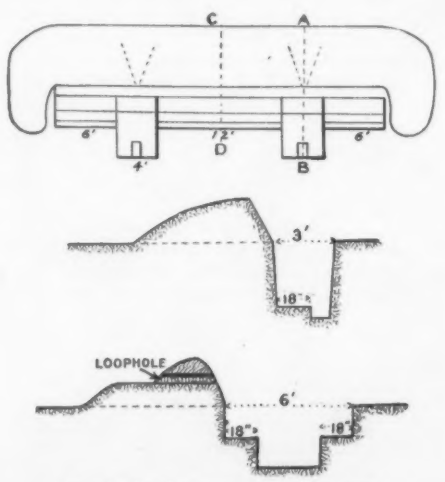


FIG. 19.—Emplacement for machine guns.

that had promised results of great importance in bringing the war to a successful close, and yet the defenders, by their failure to take the offensive at this time, are clearly at a great moral and physical disadvantage, and will be greatly handicapped when the question of peace terms is brought up for discussion. It must be quite evident that the invaders are in position practically to dictate the terms on which peace shall finally be declared.

Hence the axiom in war: Real success results only from offensive operations.

Field Fortifications.

Field fortifications deal with such works of a temporary character as may be constructed in time of war by troops in the field, for a specific purpose, with the tools usually carried by the troops as part of their equipment, and with the material found in the locality. It may sometimes happen that the necessity for the field works under preparation may pass before the job is completed.

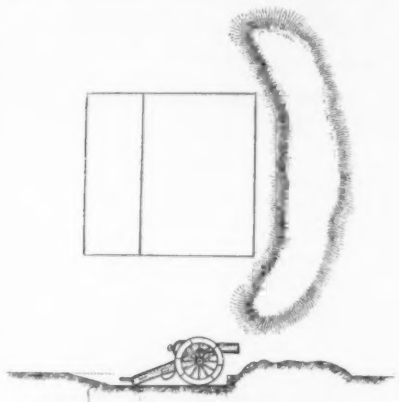


FIG. 21.—A simple type of hasty gun pit; easy to construct; gives practically as much protection as Fig. 17 (without the splinter-proof cover), and is very suitable in connection with shelter trenches.

Field fortifications may be divided into hasty intrenchments used by troops upon the battlefield to increase or prolong their powers; and deliberate intrenchments, not in line of battle, such as may be required to protect lines of communications and supply, lines of retreat or to strengthen a position in readiness.

It often happens that a line of lying down trenches may develop into a line of deep trenches with splinter proofs, cover, and communication trenches for the supports as well as gun emplacements for the artillery; thus taking on all the characteristics of a position in readiness.

FIG. 20.—Section of parapet in loose soil.

Redoubts (see Fig. 15) are the most complicated types of field fortifications, and in some instances have compelled an assailant to resort to a siege to secure the capture of the position. This, however, was before the days of the 11-inch howitzer.

When conditions and time permit and the materials and men are plentiful, a great deal of care may be devoted to the details of construction so as to produce finished work, perfect in efficiency as well as in appearance. To this end the trace and profile are carefully laid by actual measurements, etc., but on the field of battle where quick results are required, where men are nearly exhausted by long marches and strenuous fighting, etc., even "positions in readiness" are prepared without much regard to beauty of design or absolute correctness of details.

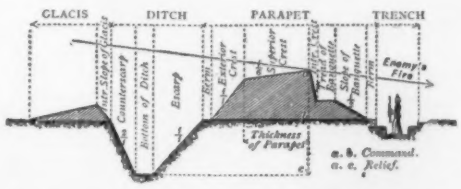


FIG. 20A.—Section of intrenchment made in stiff soil. The legends designate in military terms the various portions of such an intrenchment.

How Intrenchments Are Made.

Intrenchments are used both on the offensive and on the defensive whenever circumstances permit. The cover provided by intrenchments is a defensive weapon of which full use should be made by commanders of all grades on their own initiative. The intrenching tools provided for infantry (Figs. 1 to 6) form a part of the combat equipment of that arm, and are invariably carried into action. Additional axes, picks, and shovels of the regular size are carried in the battalion ammunition wagon and in the regimental engineer wagon.

The primary object of intrenchments on the defensive is to enable a comparatively small part of a command to hold an extended front in order that the remainder may be available for offensive operations. It is, therefore, essential that higher commanders realize the full possibilities of field intrenchments, and that subordinate commanders be prepared to construct and mend them in the shortest possible time.

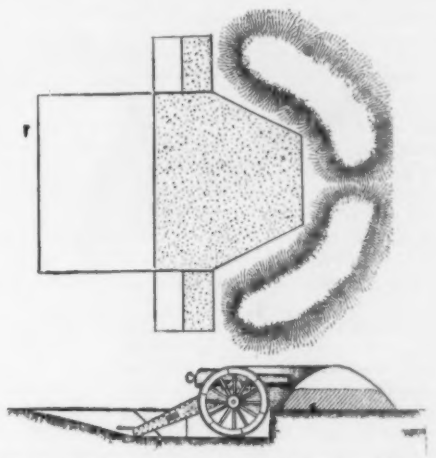


FIG. 22.—Hasty gun pit; protection in front and on the sides. Seven men, with full size picks and shovels, will construct this in one hour.

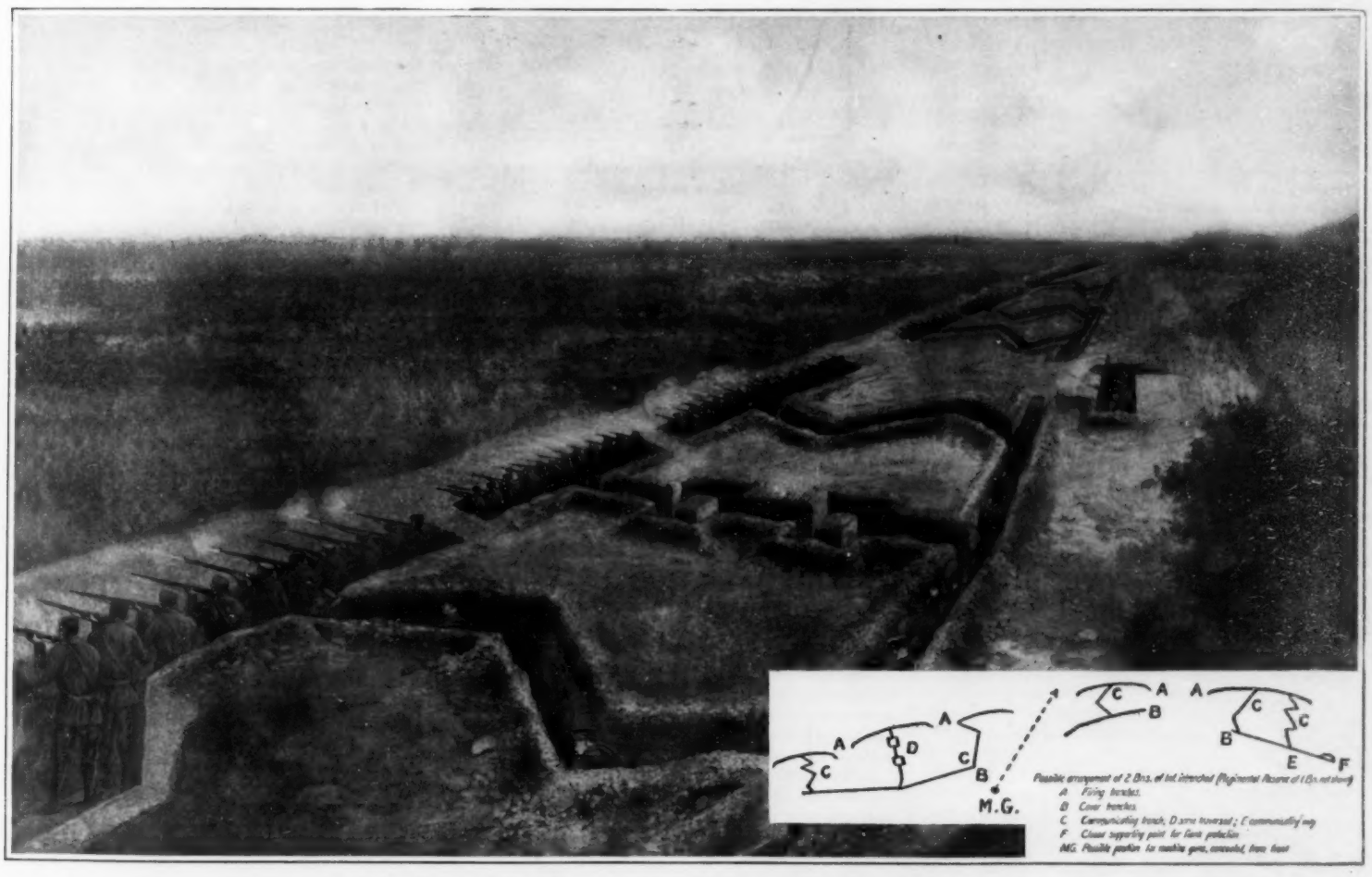


Fig. 25.—The line or lines of trenches may or may not be continuous.

The communicating trenches connecting the firing with the cover trenches are so constructed that they cannot be swept by fire for their whole length.

FIG. 23.—Simple gun pit. Gun in position for indirect firing over the crest of the hill.

FIG. 24.—Simple gun pit on crest of a hill. Gun in position for direct firing.

We are told that the Japanese soldier is an indefatigable digger. During the Russo-Japanese war, the little men of Nippon were either marching, fighting, or digging. It is well to consider, in this connection, the fact that racial characteristics vary greatly, and what may be expected of the soldiers of one race may prove impracticable for those of another race. The successful commander will know when the endurance of his men is near the breaking point, and he will stop

with a fair margin of safety between himself and possible disaster.

The following tables, taken from the field service regulations of the United States Army, will be found of interest:

Range.	Rifle.	Field artillery.	Heavy artillery.
	Yards.	Yards.	Yards.
Distant	Over 2,000	Over 4,500	Over 6,500
Long	2,000 to 1,200	4,500 to 3,500	6,000 to 4,000
Effective	1,200 to 600	3,500 to 2,500	4,000 to 2,500
Close	Under 600	Under 2,500	Under 2,500

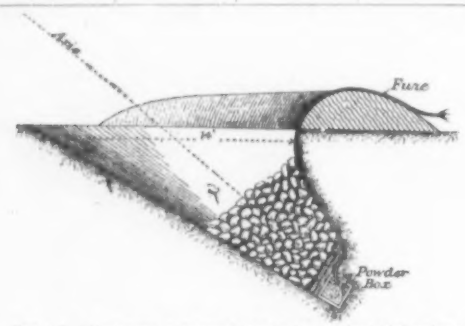


FIG. 27.—Fougasse, a type of land mine of doubtful value.

PENETRATION OF RIFLE BULLET.

Material.	Inches.	
	200 yards.	600 yards.
Commercial steel	0.30	0.20
One-inch broken stone, gravel	4.80	4.28
Hard coal between 1-inch boards	9.00	7.00
Brick masonry, cement[1]	2.20	1.16
Brick masonry, lime[1]	2.40	1.14
Sand, dry[2]	18.18	11.96
Concrete, port, 1-3-5	3.00	1.86
Oak	26.46	12.46
Sand, wet	30.00	13.00
Pine	25.72	13.00
Earth, loam	30.00	16.12
Grease clay	60.00	32.00

[1] For single shot.
[2] In sacks, about one-half these figures.

Effect of Artillery Fire.

Up to 3,000 yards, the 3-inch field gun, using high explosive shell, is effective against ordinary types of overhead cover for field trenches, brick buildings, and stone walls 2 feet thick. It is ineffective against earthen parapets.

The heavier types of field guns and howitzers are effective against all kinds of field works, and protection against this kind of fire must be secured by concealment.

AVERAGE RESULTS OF ONE MAN HOUR LABOR.

Excavation—
In easy Soil—
First hour ..... cubic feet[1] 30
Second hour ..... " " 25
Third hour ..... " " 15
Thereafter continuous work ..... " " 10
In hard soil, about half the above.
In loose earth, 60 cubic feet.
Filling sand bags, 20 bags (0.5 cubic foot each).
Revetment construction (material and tools on hand):
Rough brush wood or plank..sq. ft. per man hour 40
Brushwood hurdles, rough—
Making ..... " " " " " 15
Placing ..... " " " " " 30
Sand bags—
Filling ..... " " " " " 10
Placing ..... " " " " " 20
Sod—
Obtaining sod for ..... " " " " " 7
Placing ..... " " " " " 10
Obstacle construction (material and tools on hand)—
Abattis, wired (1 strong row).....linear feet 1.5

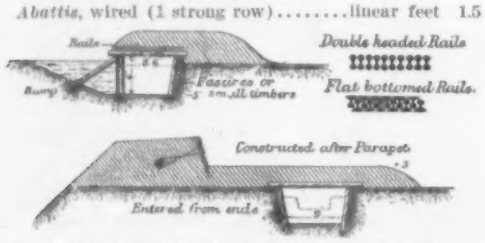


FIG. 28.—Types of field casemates and bomb-proofs.

Wire entanglement—
High .....square feet 27
Low ..... " " 90

[1] By working in two reliefs above figures can be increased by one third.

Clearing[1]—
Thickets up to 1.5 inch diameter ...square yards 25
Light clearing of soft woods, trees
to 12 inches in diameter..... " " 25
Medium clearing ..... " " 15

The Principle Regulating Use of Intrenchments.

The principle that regulates the use of intrenchments by troops on the defensive and by troops on the offensive is expressed in the following words taken from the Field Service Regulations of the Army of the United States, page 72:

"On the defensive the artificial strengthening of the position taken up is limited only by the time and the facilities available. On the offensive, intrenchments are used on all lines that are to be held for any length of time. Troops advancing to the attack must understand that the best protection against losses is afforded by an uninterrupted and vigorous advance toward the enemy's position, and by the use of such natural cover as the ground offers. In the attack intrenchments will be used only when further advance is for some time impossible, and to hold ground already gained."

It is quite evident that as a general rule troops on the offensive will be restricted to the use of the types of trenches shown in Figs. 9, 10, 11, and 12.

It may happen that when fighting extends along a front of many miles, some troops may be more successful than others, and thus gain ground much in advance of the general line. This, if permitted to proceed to any great distance, would have the tendency to leave gaps in the line, or weak spots on the flanks of the

Fig. 26.—Loopholes made of sandbags. Note the use of barricades.

successful troops which would prove most dangerous to the general line, as well as to the advanced troops themselves, if confronted by a tenacious and aggressive opponent. Furthermore, the success of the campaign does not depend on isolated advantages of individual units, but on the successful advance of the entire line, the several units (divisions, army corps, or field armies) supporting each other in the forward movement, all under the general supervision of the commander-in-chief. Therefore, it may be necessary to hold back the more advanced portion of the line until the other units are able to come up to it. To enable them to hold what they have won the advanced troops will intrench. The type of trench selected would probably be one of those shown in Fig. 10 or Fig. 11, to be enlarged later, if time permits, into that shown in Fig. 13.

If time will permit, the position may be further strengthened by digging cover trenches for the supports and reserves, building bomb-proof shelter for the men in the trenches, Figs. 14 and 15, and intrenchments for machine guns, Fig. 19, and field artillery, Figs. 16 and 17.

The line or lines of trenches are not necessarily continuous. They usually form irregular groups of intrenchments distributed along the front of the position, the firing trenches facing the enemy's lines or the avenues of approach (see Fig. 25).

It would be well to note at this point that this advanced part of the line, while still a factor in the general offensive movement, has now assumed a defensive attitude "seeking a favorable decision," which means

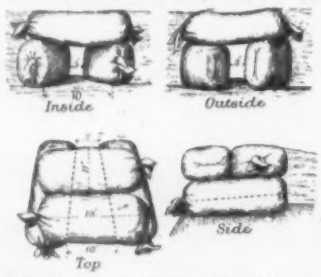


FIG. 29.—Loopholes made of sand bags.

that it is simply waiting for the opportunity to resume the offensive, and that is the only form of defense that can secure positive results.

[2] Removal of cuttings in both cases involves an equal amount of labor.

Time is a great factor in connection with field works, especially hasty intrenchments.

Different Trenches and When They are Used.

The simplest form is generally used by the advance under fire. The advancing line may have suffered great

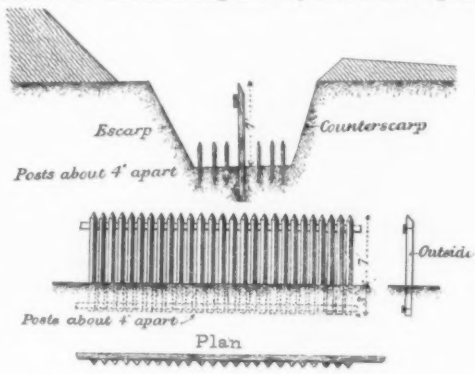


FIG. 30.—Pallisades in dry ditch in front of parapet.

losses, or the ammunition may be running low. At all events, it finds itself unable to gain ground to the front. To retreat would be fatal. It must remain where it is—some of the men find natural cover, but many must provide artificial protection from the enemy's rifle fire. The men are lying down as flat as they can. To arise, even to a kneeling position means death or a disabling wound. The necessity for cover under these circumstances caused men to devise the lying down trench, sometimes called the skirmishers' trench, Fig. 9. It gives cover from rifle fire to a man lying down, but is absolutely no protection from shrapnel bullets. The height of the parapet should not exceed one foot. The trench itself is about two and a half feet wide and about six feet long. It can be constructed by one man in soft ground, using the portable intrenching tools, in about 20 minutes. Under fire, as outlined in the foregoing, the man being compelled to remain in the prone position, he can mask himself from view in from 10 to 15 minutes and complete the trench in 40 to 45 minutes. In this position, and in view of the small number of portable intrenching tools carried by the company, the man would be obliged to use his knife bayonet to loosen the earth and the cover of his meat can to shovel it in front of him. One of the methods of working suggested by the text books, is to dig a trench 18 inches wide as far back as the knees; roll into it and dig 12 inches wide along side of it and down to the feet; then roll into the second cut and extend the first one back to the feet. This trench was seldom used in the Manchurian war. The best that can be said for it is that men can obtain slight cover under a hot fire with a minimum of casualties because it involves less digging, and they are partially protected from the very beginning of the work.

The kneeling trench, not illustrated, is the simplest form of trench for troops on the main line of resistance, but is fast going out of favor. It does not afford sufficient protection, and it is too visible.

Normally, the first objective will be the simplest form of the standing trench, Fig. 10. A good standing trench can be constructed in from one to one and a half hours by using regular sized tools. This trench may be enlarged and improved to obtain results shown in Figs. 11, 12, 13, and 14.

How Improved Fire-arms Have Affected Trench Digging.

Military experts have greatly modified their views in the matter of profiles of infantry trenches. These changes are due to the improvements made in firearms of all caliber, both in range and penetration, to the development of indirect and high angle fire of light and heavy field artillery, and to the possibilities of aeronautics in connections with military scouting.

A great deal more weight has been given to concealment from view. The greater depression angle of lines of vision made possible by aeroplane observation should also receive consideration.

FIG. 31.—Felled tree obstacle. Branches pointing outward.

The trench that shows the least alteration in the appearance of the surface of the ground will be found to be the most satisfactory. For this reason, instead of making the exterior slope as steep as the material of

which it consists will stand (Fig. 20) it will be better to make it "as flat as the supply of material and the labor of placing it will permit, and the superior and exterior slopes should either be merged (Figs. 10, 11, and 12), or make a small angle with each other, and in the latter case should be joined by a curve." (Part V. E. F. M., U. S. A.)

Elbow rests and overhead cover, no matter how slight, are considered essential.

So great is the necessity of concealment as shown in recent war experiences, that many experts are beginning to question the value of great redoubts and similar types of field fortifications, as these cannot be used in positions exposed to artillery fire unless they can be so constructed and disguised that they cannot be recognized as such from the enemy's artillery positions. When we consider the possibility of discovery by the military observer scouting in his aeroplane several thousand feet above the position, with his ability to indicate by signals while in the air or by means of a position sketch after he returns to his lines, the exact location of the redoubt and supporting batteries, we must realize that imposing works with prominent parapets and gun emplacements as illustrated in the text books, are things of the past. In ordinary rolling country the conditions of defense will be fully met by the infantry standing trench with communication and cover trenches for the supports, reserves and ammunition. These, if located on carefully selected points will answer all the requirements of redoubts without resorting to the use of closed works.

The improvements made in field artillery fire make it possible for batteries to do effective work without much exposure or danger from rifle fire.

The simplest form of protection, Figs. 21, 22, 23, and 24, will probably answer all the requirements.

Concealed Men Firing at Concealed Targets.

In the old days, the gunner had to see his target. He stood at the elevating wheel, looking through the rear sight and indicating the horizontal direction of the piece to the man who stood at the trail, ready to move it to the right or left as directed by the gun corporal; the latter raised or lowered the breech until the front sight rested on the target; the signal was given and the gun fired. Now, however, things are done differently. The gunners need not see the target at all. The battery commander with his assistants stationed on a flank of the line of guns, in prolongation of this line or directly in rear of and above it, watches the effect of the firing and gives all the directions as to the aiming point—which is *not* the target—and the range elevation, kind of fire, type of projectile, etc., to be used. The battery commander gets most of his data by means of a wonderful instrument called the battery commander's telescope. His station is connected with each gun by telephone or buzzer.

The aiming point (not the target) must be selected with care, "something tall and slender such as a flag staff or church steeple is best. It should preferably be a mile or more distant" (Notes on F. A.).

The battery commander's problem is "to determine the deflection that must be set off on the sight, so that when the sight is brought to bear upon the aiming point the gun shall be trained upon the target" (Notes on F. A.). This sounds very complicated, but the trained artillerist gets wonderful results in an astonishingly short time—just a few minutes from the time the position has been selected.

In addition to the trenches, including parapets, ditches, abattis, trous de loup, wire entanglements, etc., shown in Fig. 15 as means of defense, we must not forget that in thickly populated countries, armies often find it necessary to hold small towns and villages, as these often form part of the line of defense, or are included in it on account of their location in proximity thereto. (Figs. 18 and 26.)

The Use of Mines.

Land mines are usually formed by excavation from the surface and are designed to be exploded at the moment the enemy is over them. Such mines are usually employed in front of defensive positions, prepared in advance, in connection with visible obstacles, such as abattis, wire entanglements, etc. The charge is placed near the surface, just deep enough to avoid artillery projectiles. The mines may be placed in several rows, and their positions concealed as completely as possible.

If everything works well and the enemy will congregate on the mined ground these mines and the fougasses (Fig. 27) should do great execution. As a matter of fact, past experience shows that the results do not warrant the time and labor expended in their preparation. In addition to this, the craters formed by the explosions make an excellent line of trenches for the attackers.

In conclusion we may say that many of the simpler forms of field fortifications described in this article and in text books will continue to be used, more or less extensively, by troops on the defensive and to a lesser degree by troops on the offensive.

That greater weight should be given to concealment of the line of works. That in the preparation of the trenches provisions should be made to enable the troops manning them to leave them quickly to take part in a counter attack on the assailant or to take up a new position in rear. Troops that have been fighting for days or weeks with varying success are apt, when they find themselves behind strong intrenchments that have cost them additional efforts, to hesitate about leaving them; they feel secure and know that they need rest. Their mobility is seriously affected if not paralyzed. Commanders of troops must realize the advantages as well as the disadvantages of intrenchments, bearing in mind that real success in war depends on offensive operations, and that troops on the offensive should be taught and encouraged to depend for their protection on the intelligent use of such natural cover as the ground over which they are advancing may offer; on the accuracy and intensity of their rifle fire; and, above all, on their determination to get close to the enemy as soon as possible and drive him out of his position at the point of the bayonet.

Strategic Moves of the War

Letter from the Military Expert of the SCIENTIFIC AMERICAN, September 25th, 1914

The French Campaign.

THE week has seen a slow development of the great battle of the Aisne. Reinforcements have been rushed to the German right to enable Generals von Kluck and von Buelow to resist the French and British attacks. All garrison detachments that could be spared have been united with reserve corps to form a new army under General von Boehm to protect the German right flank.

The German line runs from near Lille, south to Soissons, then east to Etain, 20 miles northeast of Verdun, and then southeast, near the French border, to the Vosges Mountains, and on *via* Mulhausen to the Swiss border. The Allies are trying to break through this line near St. Quentin in the north and also in the hills north of Verdun. The Germans are trying the same strategy under more unfavorable conditions just east of Rheims, and also north of Toul.

Both of the opposing armies are trying the same strategy; the side that succeeds first will force the other back. The danger in having the line pierced lies in the breaking up of the co-ordination of the armies of the defense. When such immense forces are engaged every step of the operations requires co-operation. If the plan is broken up it is difficult to gather up the loose ends to fit the new conditions. The successful assailant has better control of his forces, and can readily turn them where they will gain the greatest results. By concentrating first on one part and later on the other of the divided enemy he can crush the opposing armies in detail. The German attacks north of Toul have in front of them the formidable obstacle of the French line of forts along the hills on the east side of the Meuse. The French advance into the hills of the Ardennes is directed against the German fifth army, under the Prussian Crown Prince, well situated for ready reinforcement *via* Luxemburg. The German counter attacks east of Rheims are made from a part of their line where reinforcement and supply are difficult on account of lack of railroads. It will require difficult and costly assaults for any of these moves to succeed.

The importance of the Allies' turning move against St. Quentin lies in its approach to the line of communications through the Sambre and Meuse valleys. Just as the cutting of an artery will disable a limb, so will the cutting of the supply lines of an army destroy its strength. With the enormous numbers now in the field any interruption of supply will cause starvation at the front.

So important is the maintenance of the lines of communication that their capture would be vital. These are the reasons that lead the Allies to go slow all along the line while pushing the flanking movement. If the latter succeeds the Allies will force the Germans out of their present position without the loss of life consequent upon frontal attacks.

The remarkable thing about the frontal assaults that have been so common in this war is not the great loss of life, but the fact that any men survive to reach their goal. When we remember how the Indians from Fort Du Quesne (Pittsburgh) from their vantage points behind trees mowed down the columns of British under Braddock when they advanced in the open, it seems wonderful that any troops can hope to live through an assault against men behind the shelter of trenches and parapets.

The explanation lies in the accuracy of artillery shrapnel fire. No assault can be made until the assailants have gained superiority in artillery. Their artillery then sweeps the trenches of the defense with a hail of shrapnel that keeps the defenders under cover. The assaulting infantry take advantage of this protection to work up close to the enemy. The trajectory of the shrapnel is so definite that the artillery can keep up fire until the infantry of their side are within 400 yards of the trenches. Even then the artillery fire is not stopped entirely, but is directed beyond the trenches to catch any reinforcements that the enemy may be sending up from his rear.

The artillery thus supports the infantry advance until the line is within a few short rushes of the enemy's position. At the same time the shelling of the trenches tends to shake the *morale* of the defenders, weakening their resistance to the assault.

The Russian Campaign.

The developments of the Russian campaign have progressed far enough to show the strategy of the earlier stages. As is well known, Germany gave every effort to the campaign in France. Only two active army corps were left in the northeast and one in Posen.

The Austrian army, which had been mobilizing for eight days when Germany declared war on Russia, was counted on to join the German landwehr armies to delay the Russian advance. To this end Austria concentrated six corps in Galicia and sent them north on both banks of the Vistula to take in flank the expected Russian advance through Poland.

The expected delay in Russian concentration led Austria to send two corps to the Rhine to hasten the decision in the western theater. These corps were moved back east after the strength of the Russian Galician invasion was developed, but their support was lost from the operations up to Lemberg.

A further factor in upsetting the Austrian plan was the strong resistance put up by Servia. To match the four Servian corps Austria had to keep four first line corps in the south. As the Servian campaign developed Austria had to send large numbers of reserves to this theater to offset the effects of the Servian victory at Sabac. The dangers from a Servian invasion are so great that Austria has to make sure of her southern boundary even at the expense of taking chances in the north.

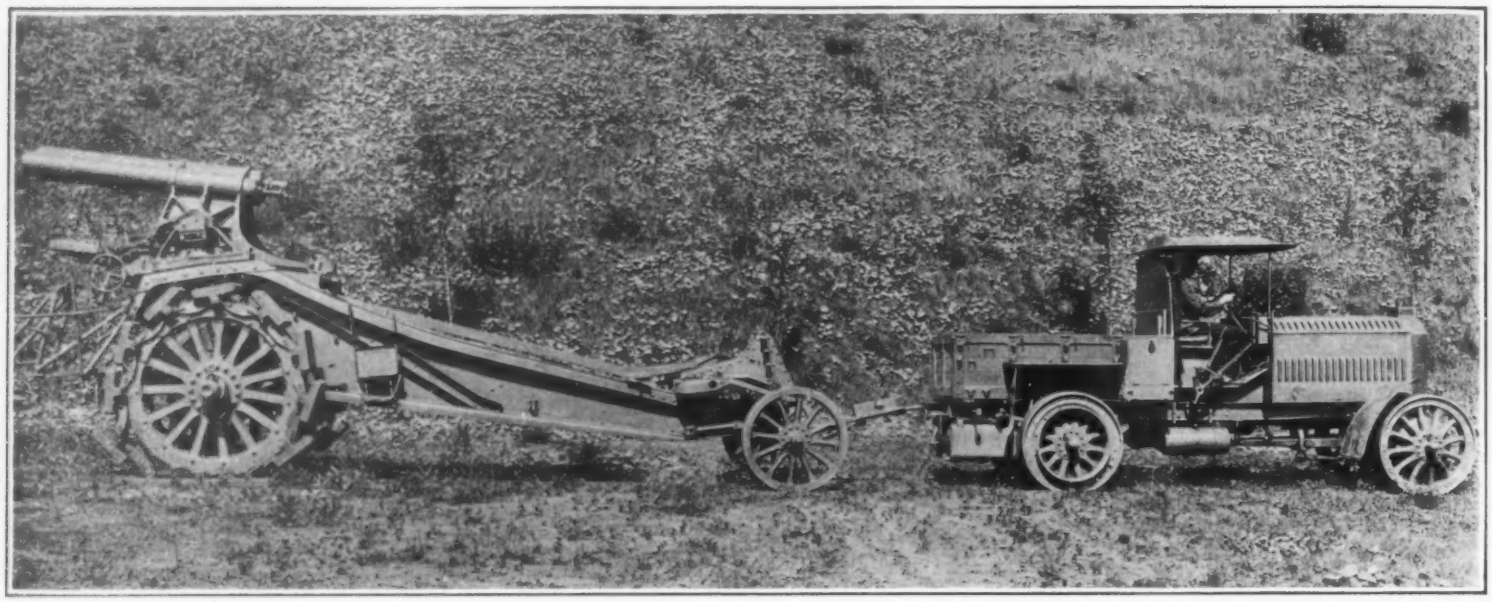
The Austrian army in Eastern Galicia was so outnumbered by the armies of the Russian invasion that it was forced back rapidly to the Grodek lines west of Lemberg. The strategic invasion of Poland was also pressed back to the Krasnik-Tomaszow line. The two armies occupied a quadrant from the Vistula River to the Carpathian Mountains, held by four Austrian armies.

The Russians advanced against them in four armies, two of which concentrated on the Austrian center at Tomaszow. The Russians broke through after three days stubborn fighting and forced the Austrians to fall back to the line of the San and Vistula rivers.

In this strong position the Austrians might have been expected to make a stand, but they were threatened by a new danger. A strong Russian force advancing on the west bank of the Vistula was attempting to get beyond the west flank of the Austrian line. A success in this move would give the Russians a central position between the Austrian Galician armies and the German armies in Silesia. With these deprived of mutual support the Russians could turn the bulk of their forces first on one and then on the other, crushing them in turn.

For this reason rather than any decisive defeat the Austrians are forced to move rapidly to the west in order to maintain concerted action with their German allies.

The Russian invasion of East Prussia now appears to have been intended as a demonstration. By striking the first blow here, Russia led Germany to rush her reserves to the northwest to reinforce her two active corps and the local reserves. By this move the Germans regained superiority in numbers and forced the Russians back to the Niemen River, but the Austrians were left practically unsupported to receive the full force of the main Russian army.



Gun carriage of German 11-inch field mortar, hauled by motor truck.

Mobile Siege Guns in the Present War

The Powerful Mortars Which Would Have Quickly Reduced the Paris Fortifications

ONE of the most striking developments brought to light, or at least brought to public attention, by the present war, is the enormous size and power of the mobile artillery with which the contending armies, and particularly those of Germany, are equipped. The most formidable of these weapons, the one which has attracted most attention in the present war, is the enormous 11-inch siege mortar, which, in the accompanying illustration, is shown in transit, and is depicted in action on the colored cover inclosing this issue.

The 11-inch mortar was developed and constructed in large numbers at the famous ordnance works of Krupp at Essen. In respect of size, weight and destructive power this piece marks the climax of a rapid development of heavy ordnance capable of being transported with an army and quickly emplaced for the reduction of permanent fortifications, such as those which were reduced at Liege and Namur. Up to the time of the Russo-Japanese War, a distinction was made between heavy and light siege units. The latter were mounted upon wheeled carriages, and they were capable of being moved with an army on the march. The heavier siege units, say of from 9-inch to 11-inch caliber, required special means for their transportation. The massive parts, such as the gun and its carriage, had to be conveyed by standard gage railway or by ship to some place adjacent to the field of operations, whence it was customary to lay a light military railroad or devise other special means for transporting the batteries to the locations assigned to them. Before the mortars could be erected and placed in working order, it was necessary to provide heavy masonry foundations, of sufficient area and mass to withstand the heavy shock of recoil. It can readily be understood that this preliminary work entailed the loss of much valuable time.

This was the method employed by the Japanese in the reduction of Port Arthur. This enterprising people was the first to employ 11-inch siege guns for the reduction of permanent fortifications. They dismantled a large number of their coast defense mortars in Japan; transported them by sea to the port of Dalny; laid a light military railroad from Dalny to the base at the hills encircling Port Arthur; built heavy concrete foundations; and erected upon them the mortars and their gun carriages. It was these siege pieces which assisted in the sinking of the Russian ships in Port Arthur, and contributed very largely to the reduction of the forts which crowned the hills around that city.

The heaviest French siege piece is a 10.7-inch howitzer. This piece was tested during the maneuvers of 1907 in the siege of Langres. For field work or for transportation for the siege of fortifications it is horse-drawn, being carried in four parts on separate carriages, one carrying the gun, another the carriage, a third the slide, and a fourth the platform.

The German 11-inch mortar marks a great stride in power and weight, and particularly in mobility, over any other mobile artillery as yet constructed. The outstanding feature of this great mortar is that it is so mounted that the gun and its carriage can be hauled either by motors or by horse-power at a speed approximating that of the lighter siege artillery, and that when it has reached the designated position, it takes but a short time to have the gun in battery, ready for the attack.

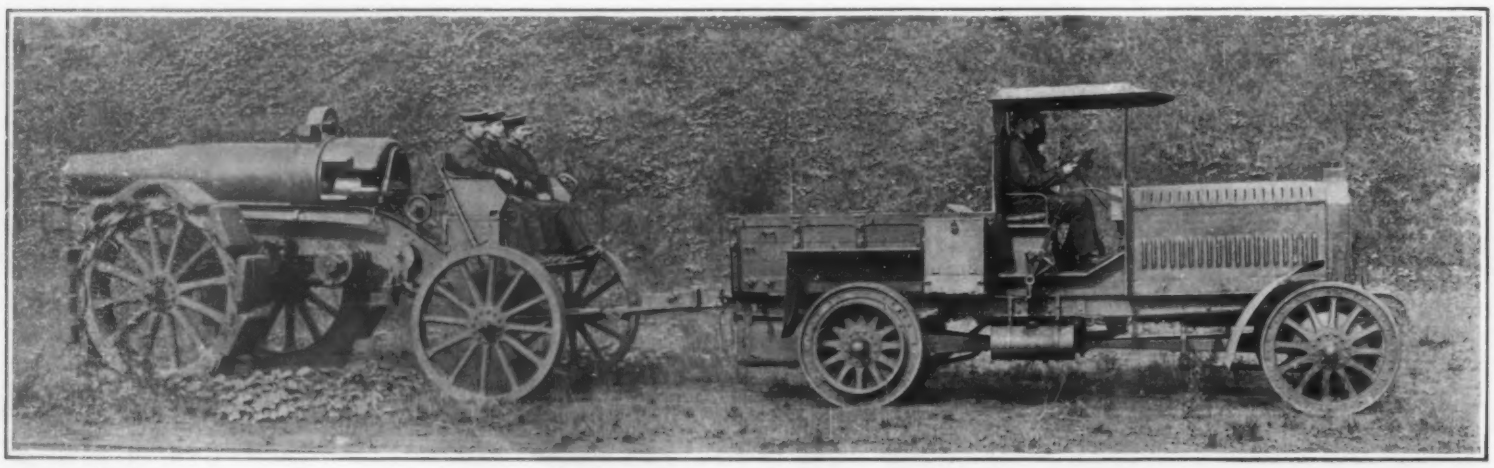
The barrel of the gun is made of steel, and it consists of the inner tube and an outer jacket, the total length of the gun being 11 feet. The breech is opened and closed by turning a handle through a horizontal arc for about 135 degrees; and a safety device operated by hand is provided which prevents premature firing or accidental opening of the breech. In spite of the fact that the breech mechanism weighs over 1,100 pounds, the construction is such that the opening and closing of it can be effected easily with one hand and in a few seconds time.

The gun is transported on two separate vehicles, each of which can be hauled as shown in our illustration by a single motor truck. During transportation one unit consists of the gun carriage, slide, recoil cylinders, trail, and permanent axle and wheels, the last-named being fitted with broad flat feet after the manner of the Diplock pedrail. The after end of the trail during transportation is mounted upon a pair of wheels as shown in the illustration. The gun itself is transported upon a carriage upon which it is placed in such a position that the majority of the weight will come upon a pair of pedrail wheels.

To mount the gun when it has reached its assigned place, all that is necessary is to back up the section carrying the gun against the section constituting the mount, and then, by means of wire cables, draw the gun forward into the sleeve and bolt the lug (which is shown on the top of the gun near the breech) to the piston rod of the recoil cylinder. The gun transporting section is then drawn away, the trail is lowered to the ground, and the gun is ready for firing.

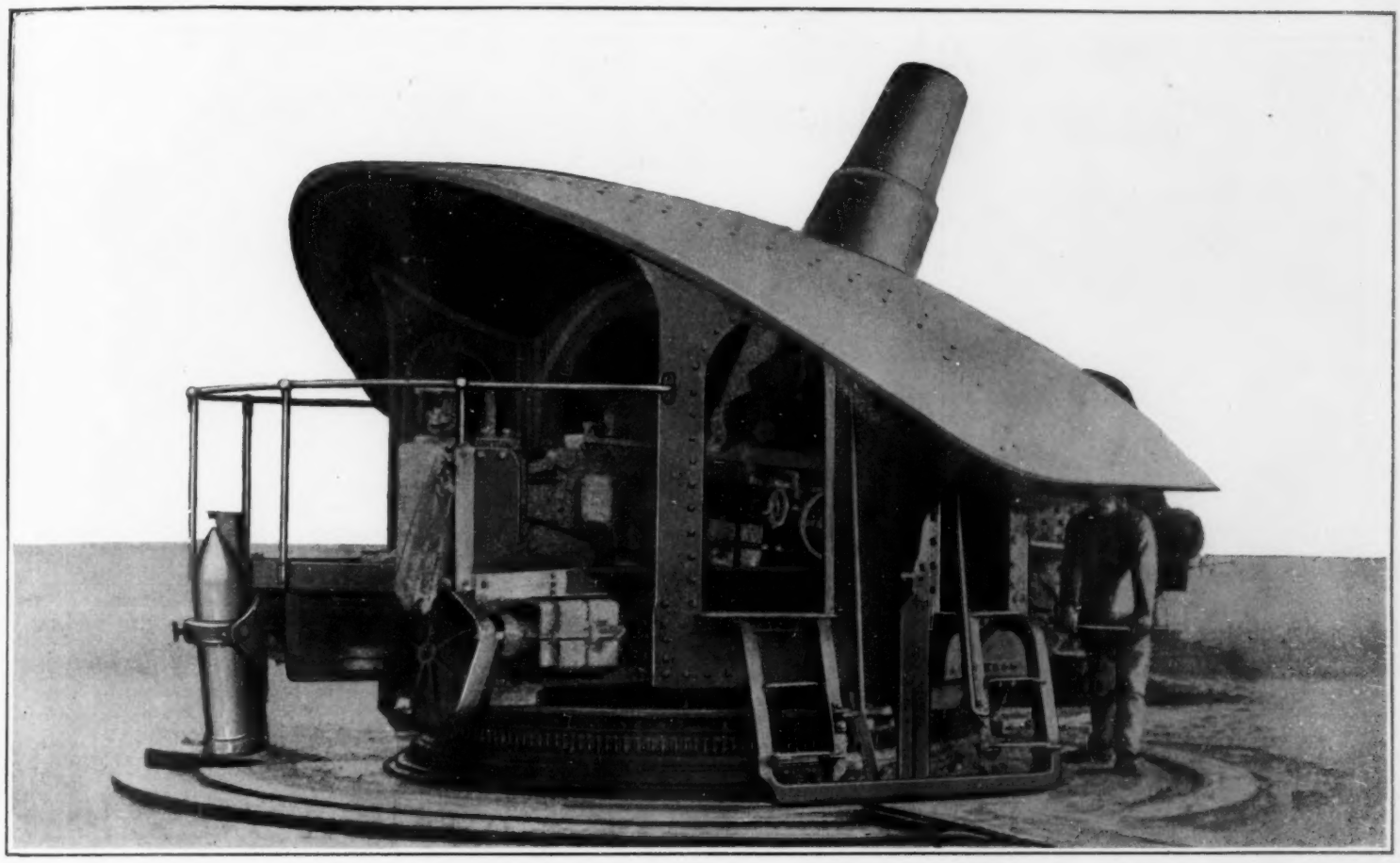
The training gear gives a maximum elevation to the mortar of 65 degrees, and it works upon a rapid system. The gun can also be traversed through an arc of 10 degrees horizontally, that is, five degrees on either side of the longitudinal center line of the carriage. The upper part of the cradle in which the gun slides carries a group of three cylinders. The central cylinder acts as a recoil brake, while that on either side is an air reservoir. The gun, as we have said, is connected, not to the brake cylinders, but to the piston rod; the brake cylinder remains stationary during the recoil, and it is the piston rod and the piston which move to the rear with the gun.

Exact particulars as to the weight of shell and bal-



This is the gun which reduced the forts at Liège and Namur.

The 11-inch mortar in transit on a separate carriage, from which it is transferred to its mounting.



Krupp 11-inch siege mortar mounted on permanent concrete platform.

listic features of the 11-inch mortar are not available; but by comparison with our own 12-inch mortar it may be assumed that the following particulars are not far from the facts: The weight of the gun and its carriage, etc., for transportation is nearly 40 tons. The weight of the shell is about 750 pounds. The maximum range at an elevation of 65 degrees is 24,250 feet, and the maximum range at 42½ degrees elevation is a little over 33,000 feet.

As upon the sea, so upon the land, the attack has overmastered the defense; for it may be stated with little fear of contradiction that a rain of 11-inch shell falling almost vertically from an altitude of several miles would suffice to destroy the strongest fortifications existing to-day. What the high-explosive mortar shell can accomplish on such fortifications as those of Liege and Namur is shown by the illustrations of the wreckage of these forts to be found on another page of this issue; and we very much doubt if even the strongest forts around Paris would have shared a better fate if the Germans had succeeded in reaching the French capital. The Gruson turrets afforded ample protection against the direct fire of high velocity rifles and the high angle fire of the lighter siege guns which were in vogue when these forts were designed; but against these enormous 11-inch mortars, fitted with delayed-action fuses and filled with the most modern high explosives, they are helpless.

It must be admitted, however, that the very qualities of weight and power which make the 11-inch mortar such a formidable piece, nevertheless constitute a most serious problem of transportation. In spite of the skill with which the design has been worked out, with its large diameter pedrail wheels, the weight of one of these mortars is such that it demands the very best of conditions of roadway for its successful, or, at least, for its speedy transportation. To handle these pieces successfully, whether in advance or retreat, calls for

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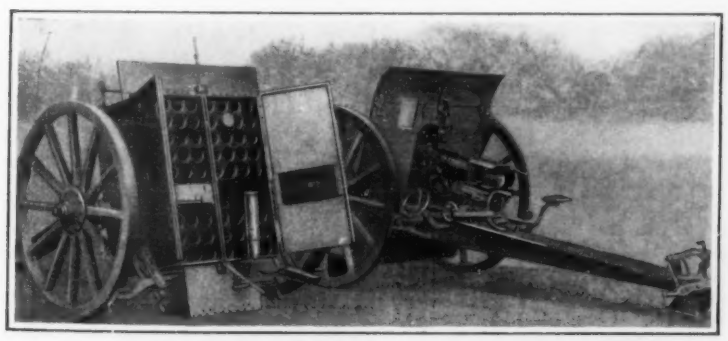
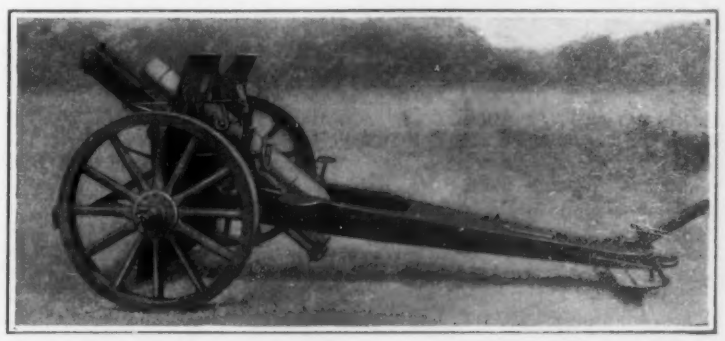
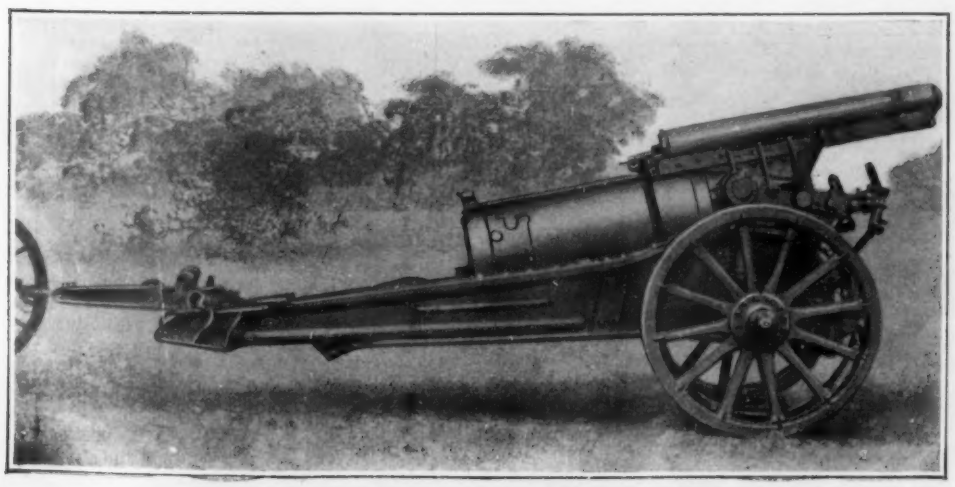


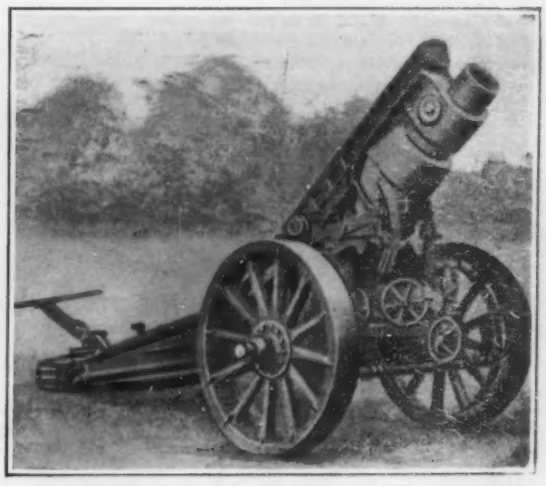
Krupp 7.5-centimeter field-piece in battery.



German 4.7-inch rapid-fire field howitzer.



The 8.25-inch field mortar, limbered up for transit.



The Krupp 8.25-inch field mortar in firing position.

Effect of German heavy siege gun fire on Liège armored cupolas.

The Turret Fort

A Description of the Famous Gruson Armored Turret Used in European Fortifications

By Major A. G. Piorkowski

A Liège cupola thrown from its mounting by German siege guns.

AFTER their first swift advance into Belgium and the withdrawal of the Belgian government from Brussels, the Germans set about the business of besieging Antwerp, not only because it had acquired new importance as the capital of Belgium, but because of its strategic value as an important point. The turning of the left wing of the Allies southward, moreover, facilitated the investment of the city. Although the Germans have been diverted from a formal siege, Antwerp claims its share of attention, chiefly because of the character of its fortifications.

Antwerp has always been a fortress and its history is full of fighting and sieges. But now its fortifications count among the most modern, and are considered an example of the present state of the military engineer's art and science. Their designer and builder, Gen. A. H. Brialmont, the Belgian engineer and writer on fortifications, has made himself famous not only by his work for the strongholds of Antwerp, but by his planning and building the defenses of Bucharest, the capital of Roumania, and of Liège and Namur. His close connection and friendship with Col. Max Schumann of the Gruson Works of Magdeburg in Germany enabled him to introduce iron and steel batteries and turrets into his fortifications, and these modern constructions probably will now have their first test in real warfare. I may say right here that modern ordnance and gunnery have made great progress in the last thirty years, since Antwerp's ramparts and forts were built, as they are now, so that it is quite doubtful whether they would prove formidable and make the siege a long one. The range and power of penetration and accuracy of modern ordnance is far superior to what it was when the tests at Bucharest, in 1883, and at Spezia, Italy, in 1886, spread the fame of the so-called Gruson turrets, which form the citadels of the Antwerp forts, and which were then adopted by the military engineers of Germany, Austria, Italy, Belgium, Roumania, Switzerland, and Holland.

Hermann Gruson was an engineer of great talent, born in Magdeburg, and whose works, now owned by the Krupp Company, are near that city. He invented what is often called the Gruson metal, a special excellent low carbon cast iron, chilled by being cast in partly iron molds, thereby attaining an extraordinary hardness of surface, without apparently weakening the tenacity.

He first used this metal for parts of machinery that required such hardness, also for railway switches and crossings and other parts which require great resistance against wearing off by friction. His next step was to use his metal for armor piercing projectiles which were very efficient for penetrating into and perforating armor plates, which at that time were rolled of soft iron or low steel. His successes in this direction carried him to the construction of chilled cast iron armor batteries and rotating turrets of such metal. The larger size and higher weight of the castings for armor brought him new problems to solve, and quite a number of inventions and new constructions were the result. Special furnaces, large troughs in which the molten metal was poured to be collected in the necessary quantity, where it was stirred and allowed to cool off to the proper temperature before it was run into the mold so as to solidify quickly after casting; new cranes to move the enormous molds, new tools to work the hard surfaces, in fact, nearly every part of the manufacture was a novelty, and made it a monopoly for Gruson.

The bulk of the Gruson armor and the hardness of its outer surface, however, are not the only great qualities which make it a powerful shield against the heavy armor-piercing projectiles. It is its characteristic dome-like shape, its curved outline, which prevent the shell from striking under an angle of impact greater than 45 degrees. Instead of striking by its point, the shell strikes by its side, is shattered, and the pieces glance off and leave the turret practically uninjured.

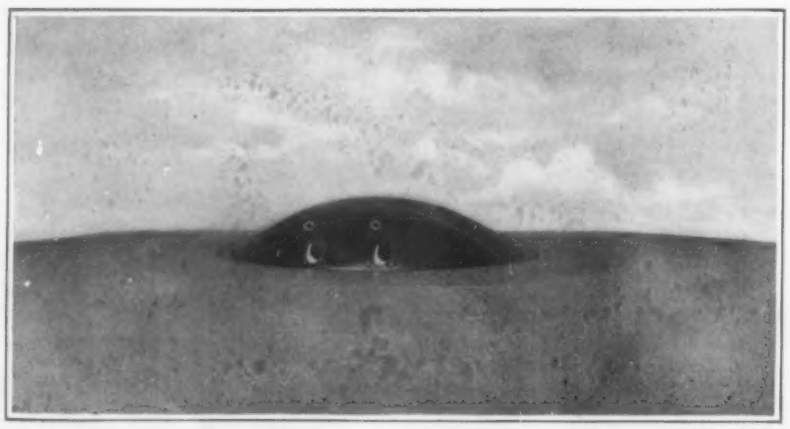
In the Spezia trials the test plate weighed 120 tons, the cast iron part of the mold in which it was cast weighed 180 tons; a special combination of four railway platform cars was built to carry the big plate from Magdeburg to Spezia. It was fired upon from an Armstrong 100-ton gun. To make the fire more efficient the plate was tipped up on an angle so as to increase the impact angle. It was placed in a tunnel to receive the pieces of the shattered shell. The first round left the surface intact, simply smoothing and polishing it at the striking point. As the firing was continued, the hits lying close together, cracks appeared, radiating from the striking points and pentrating into the interior normal to the surface. As these cracks met and formed a network of fissures pieces separated from the main body, but being more or less of the shape of vault stones, remained in place and helped even after a number of heavy rounds to what remained of the resistance of the plate. In this manner the test-plate surpassed by its resistance anything that was expected from it by the number of distinguished engineers who witnessed the test. The plates of this kind in contrast to rolled iron or steel plates are made with a thickness varying according to the inclination of the surface toward the horizontal. The Spezia test plate and the plates for the two great Italian turrets at Spezia and Tarento were 60 inches thick in the breast and tapered off to 24 inches where they join the top plates of the cupola. We need hardly say that turrets consisting of 15 such segments and 2 semi-circular top plates cannot be placed on a ship. The Gruson turrets are all in land defenses, the bigger ones in coast defenses. The plates need no backing and no bolts to fasten them and hold them together; they are only dovetailed by steel keys at the joints. The circle of plates rests on a framework made of plates and angles of rolled iron or steel riveted, and this again rests on a circle of rollers, rotating on a strong circular rail. From the breast of the cupola down this substructure with the gun-carriages, rotating machinery, and all the rest is protected by another, fixed, circle of chilled iron plates from whose upper surface runs the glacis of stone and concrete. This so-called circular or ring gallery allows the communication between turret and the masonry cellars for the service—the engines, pumps, magazines, and all other necessities.

The gun or guns rest and move in minimum embrasure gun-carriages. These represent another important invention of Gruson's. As the gun's lateral direction is given by the rotation of the turret itself, the gun-carriages are only designed to control the elevation of the guns. But the horizontal axis of this movement is not the line through the center of the trunnions as in most guns. If it were so the guns swinging up and down would leave open spaces above and below the guns in the portholes. To prevent this the horizontal axis is laid in the middle of the embrasures, which close as near as possible round the outer surface of the guns and do not allow any big splinters of the enemy's shell to penetrate into the interior of the turret. For this purpose the trunnions are in movable bearings, which slide up and down in guidings bent round that axis; which movement is made by means of hydraulic rams and controlled by the aiming gunners.

The gun-carriages and through them the guns themselves are supported by heavy girders connected with the framework substructure, and so of course share the rotation of the turret. The rollers for the rotation are of Gruson metal, and so are the broad circular rails for these rollers, and are laid with great accuracy on strong, solid stone foundations. Great accuracy and solidity is a necessity in order to rotate the great weight of the turret, substructure, gun-carriages and guns on a perfectly horizontal basis with comparative facility.

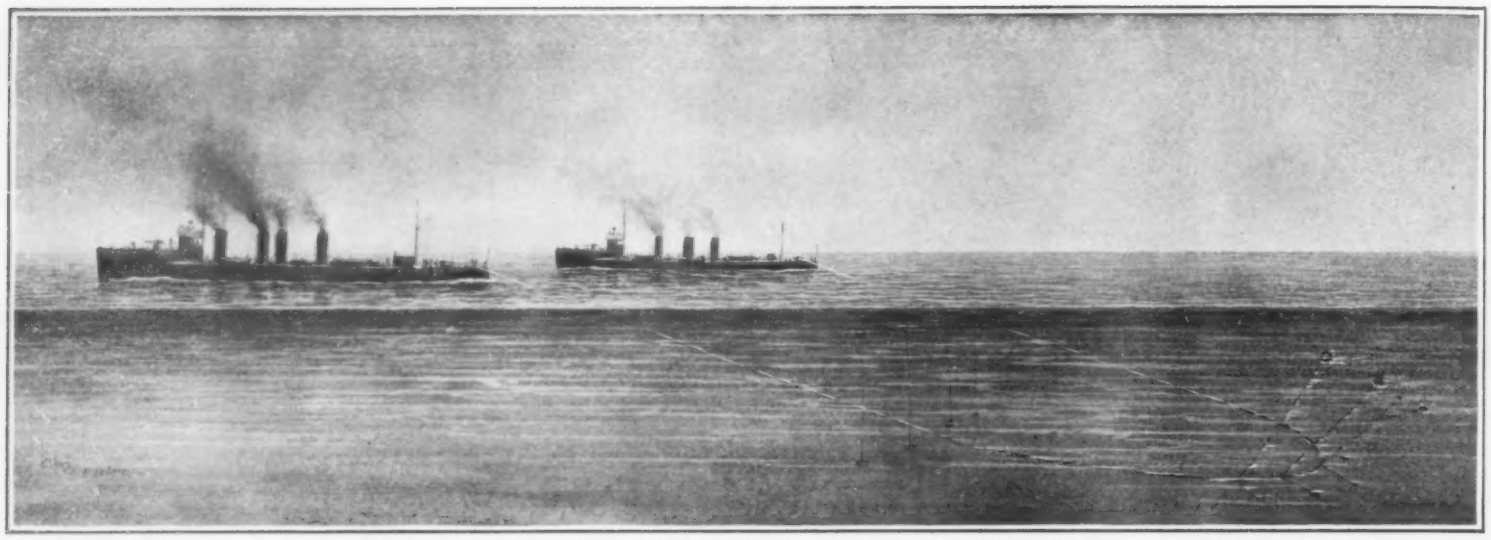
In the case of each of the two Italian 16-inch turrets, the biggest ever built, the weight amounts to a total of nearly 2,400 tons. Each contains two 16-inch 35-caliber Krupp guns. A fifth gun of this size was exhibited in 1893 in the World's Fair at Chicago, and then was known as the Big Gun. In 1902, at the Pan-American Exhibition, in Buffalo, there was a full-size model

(Concluded on page 286.)



All that is seen of the Gruson turret by the enemy.

THE GRUSON ARMORED TURRET AND ITS INTERNAL CONSTRUCTION. TURRETS OF THIS AND SIMILAR TYPES ARE TO BE FOUND IN MANY EUROPEAN FORTIFICATIONS.



Destroyers sweeping for mines by dragging a length of chain cable through the mine field.

Attack and Defense by Submarine Mines

The Most Easily Prepared and Most Dreaded Form of Naval Warfare

BECAUSE of its absolute invisibility, the submarine mine in its present state of development is the most deadly form of naval warfare. Certainly it has to its credit the greatest disasters to ships of the first class and the greatest number of such disasters during the past decade of naval history. During the operations on Port Arthur it was the floating mine which sent to the bottom two of the finest battleships of the Japanese fleet. It was a floating mine also which sank the "Petropavlovsk," when Admiral Makaroff was leading the Russian fleet out of Port Arthur, in which disaster the admiral and nearly all of the officers and crew of the ship, together with the Russian artist Verestchagin, went down with the ship. By mines, also, several war vessels of less importance were lost during the same war, and on more than one occasion Russian battleships engaged in operations at or near the entrances to Port Arthur were struck and so far disabled as to be out of action for several months' time.

As compared with torpedo attack, mining has the advantage of greater secrecy and invisibility; and this is true even when the torpedo is launched from the submarine. For effective attack, torpedoes must be fired either from battleships, cruisers or destroyers, or submarines.

In the case of each class of vessel, a ship, from the moment it sights the enemy, knows that within certain ranges it is liable to torpedo attack; and even in the case of the submarine, which must come occasionally to the surface and during most of the period of attack must occasionally have its periscope above the surface, there is a reasonable expectation that with a careful watch, some signs of the approaching danger will be detected.

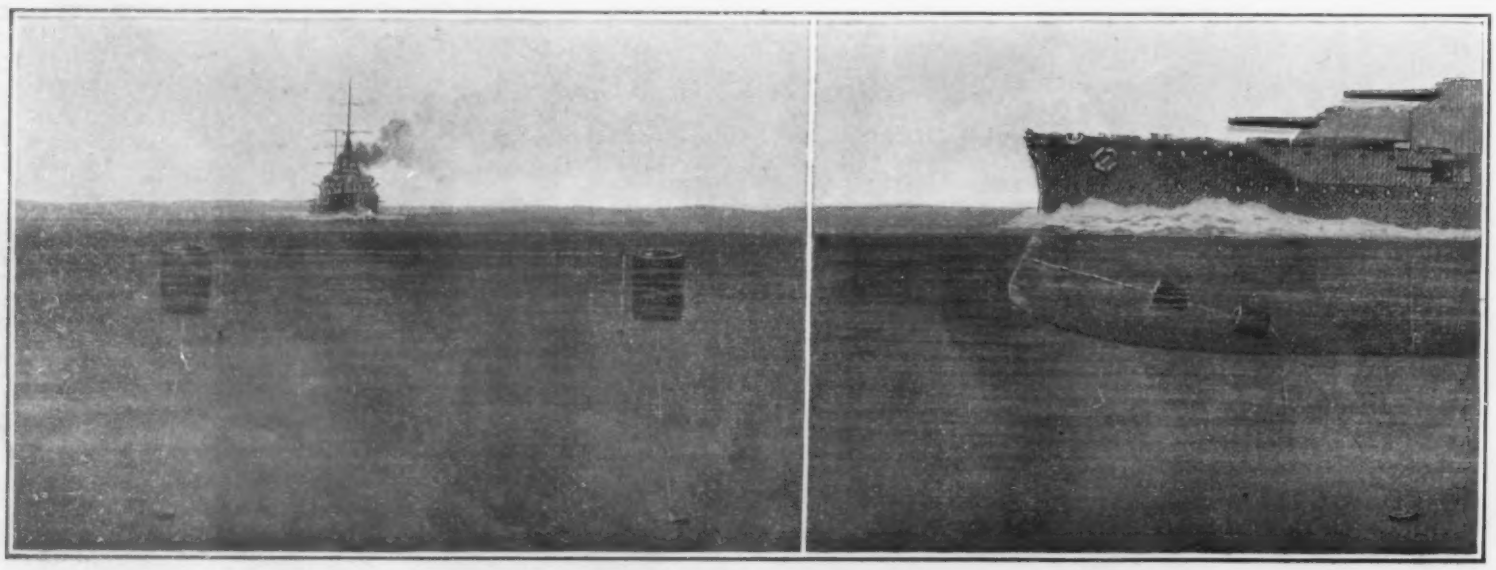
In the case of the submarine mine, however, the element of secrecy is so perfect that, if it so happens that the mine field has not been previously located, a fleet under way has no possible means of knowing when or where it may encounter these deadly machines. It is true that, when the mine field has been located, or in waters where its presence is to be expected, mines may be removed by the operation known as "sweeping," as will be explained later in the present article; but no amount of sweeping, nor the most extensive scouting, can rid the harbors and high seas which form the scheme of naval operation of this most deadly menace.

Another element which renders the mine of such deadly character is the fact that its explosive charge is not limited in amount as it is in the case of the torpedo, which generally does not carry much over 200 pounds of guncotton. The mines can be made of any desired size, and charges of as high as 500 pounds of guncotton may be contained within them. A modern dreadnought, with its extensive system of subdivision and its interior bulkheads placed so as to limit the explosive effect of a torpedo, can receive the blows of several torpedoes without being sent to the bottom. But the detonation of a single mine of large size against the side or bottom of the largest dreadnought might conceivably be sufficient to send it to the bottom; particularly if, as has so frequently happened, the shock and heat of the detonated mine has been sufficient to set off the whole of a ship's magazine. This was what happened to the "Maine" when she was sunk in Havana harbor, and similar results accounted for the sinking of the "Petropavlovsk" and the Japanese "Hatsuse."

Although the broad principle of operation of the various types is similar, submarine mines may be classified under three divisions. First, coast defense mines which are permanently anchored at a certain depth and are arranged, through electrical connections, to be exploded at will by an observer in a concealed station on shore; second, floating mines arranged to explode on contact with a ship, which are strewn broadcast by mine-laying vessels over those waters which are likely to be traversed by the ships of the enemy; third, contact mines, which are anchored in selected waters where the depth is not excessive, and are provided with an automatic mechanism that causes the mines to float at a predetermined depth, generally about fifteen feet below the surface of the sea.

The first type, harbor defense mines, is shown in the first two of the illustrations on the following page. The lower cut of these two represents the method of mining adopted during the Spanish-American war as a defense to the entrances to New York harbor such, for instance, as was used in the Narrows. In this case the mines were anchored by lengths of cable, corresponding to the depths of the channel, to heavy anchorage weights placed on the bottom, the buoyant spherical mine itself which contained the explosive, floating at a depth of ten to fifteen feet below the surface. They were laid in successive rows, transversely to the channel, and connected by electric cables with a concealed observation station on shore. In some cases mines of this type are detonated from shore when a ship is judged to be within effective range of the explosion. In other cases they are arranged to be self-firing when struck by a ship. They can also be arranged as electrical contact mines, which, on being struck by a ship, give notice by the ringing of a bell to an operator on shore, who, by the throw of a switch, fires the mine. In shallow water the mine may be laid directly on the bottom, when it is known as a ground mine; but where the depth is so great as to interfere with the destructive force of the detonation, the explosive is carried in a buoyant cylinder or sphere in the manner shown in the illustration.

The type in general use in the coast defenses in this country is the electro-contact mine, and the first of the illustrations on the following page shows a "grand group" of several mines, with its cables connected to the firing station on shore. The mines are planted in successive rows across the channel to be defended.



Anchored mines, connected in pairs by cable, which, caught by the ship, ensures a twofold explosion.

and they are "staggered," so that if a vessel should pass through the first row, it must inevitably strike one or more in the later rows. They are planted in what is known as "grand groups," which consist of twenty-one mines in groups of three. Some distance in the rear of the line of mines, there lies on the bottom of the channel a grand junction box, from which seven cables spread, each leading to a triple junction box, which in turn controls its small group of three mines. From the grand junction box, also, the multiple cable winds its way to the switchboard connection in the operating room on shore.

The grand junction box is placed at the center of the line of mines and about 100 feet to the rear. The triple junction boxes are laid in a straight line at intervals of 300 feet; from each of these boxes separate cables lead to each of three mines, the mines, twenty-one in all, being spaced 100 feet apart, in a line which extends for two thousand feet across the channel. Each mine is anchored by a cable to an anchor, the length of the cables being such that each mine will float at a depth of ten or twelve feet below the surface of the water.

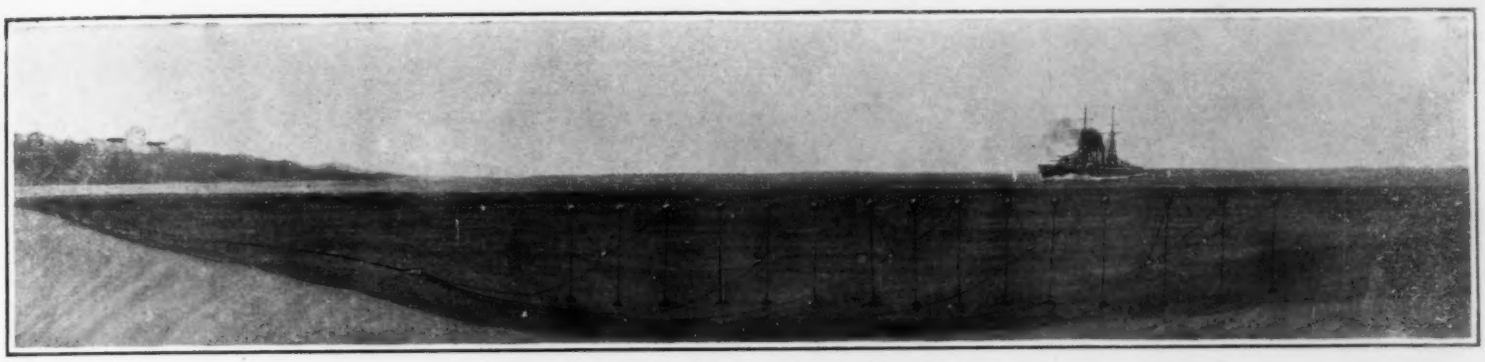
Now, it can readily be seen that since the modern warship is from 80 to nearly 100 feet in width, it would be impossible for an enemy's vessel to pass through two or three successive lines of mines, disposed as above, without coming in contact with at least two or three.

By an ingenious arrangement, one, three, or the whole grand group of mines can be fired, either from the operating room ashore, or by contact with a ship, all at the will of the operator. It is believed that for quick execution, reliability, and absolute destructive power, there is nothing equal to our Coast Defense Submarine Mine System of laying and operation.

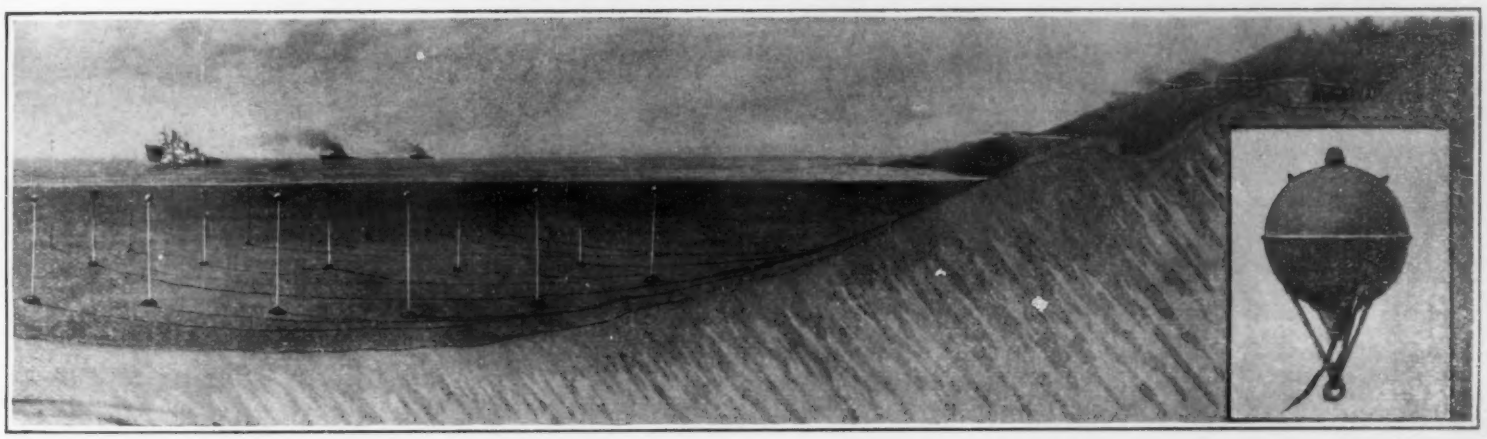
No mine field is complete, or can ever be thoroughly effective, unless it is protected by rapid-fire guns. It is possible for small boats, launches, etc., to be sent forward ahead of the ships, and set off the mines by exploding large charges of dynamite in the mine field. If the mines are within the "sympathetic radius" of the explosions they will be exploded by the shock. The most effective protection against such countermining, or against "sweeping," as it is called, is by flanking the field with batteries of rapid-fire guns.

We present also several detailed and general illustrations of the type of contact mine which is in most

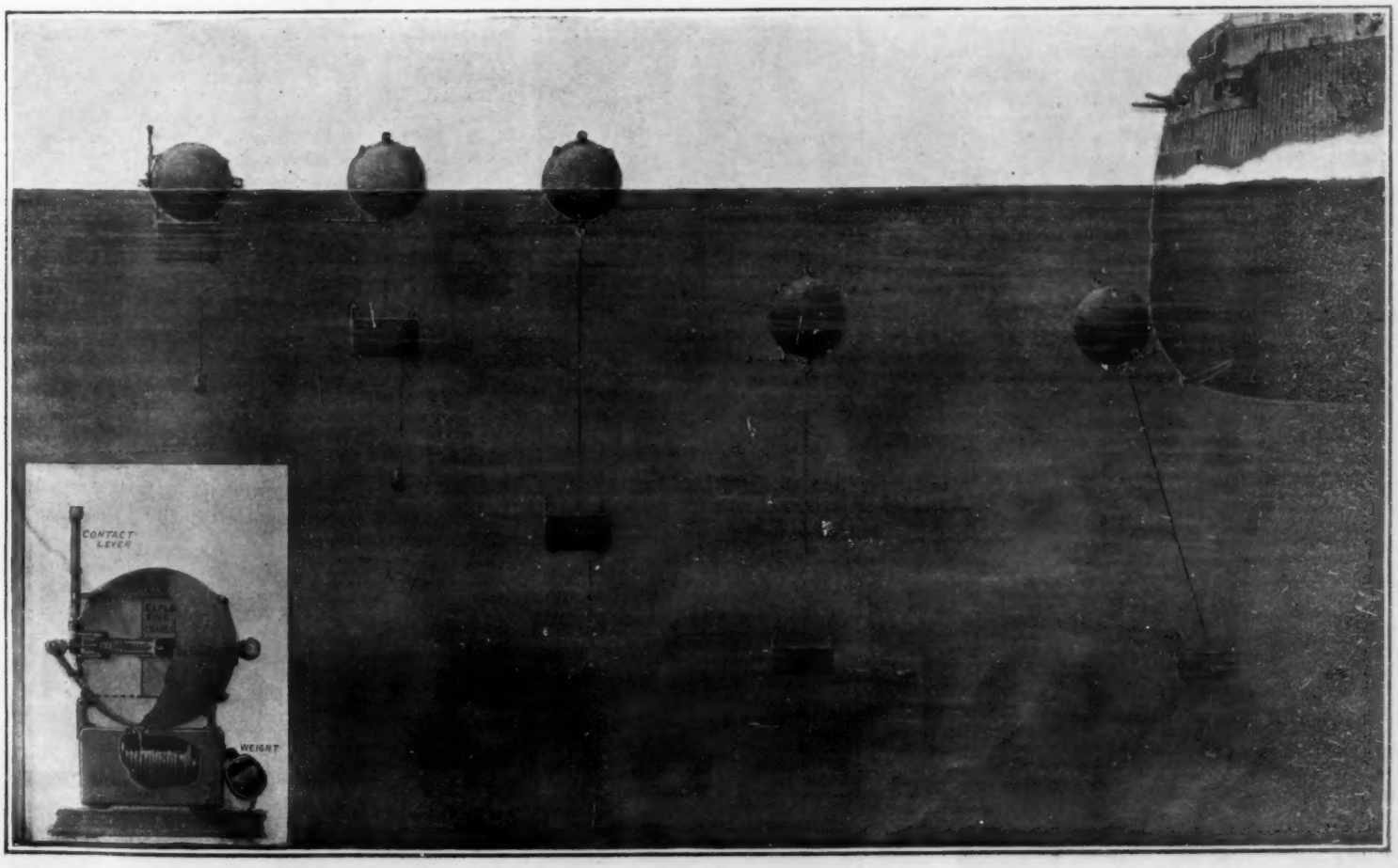
(Concluded on page 288.)



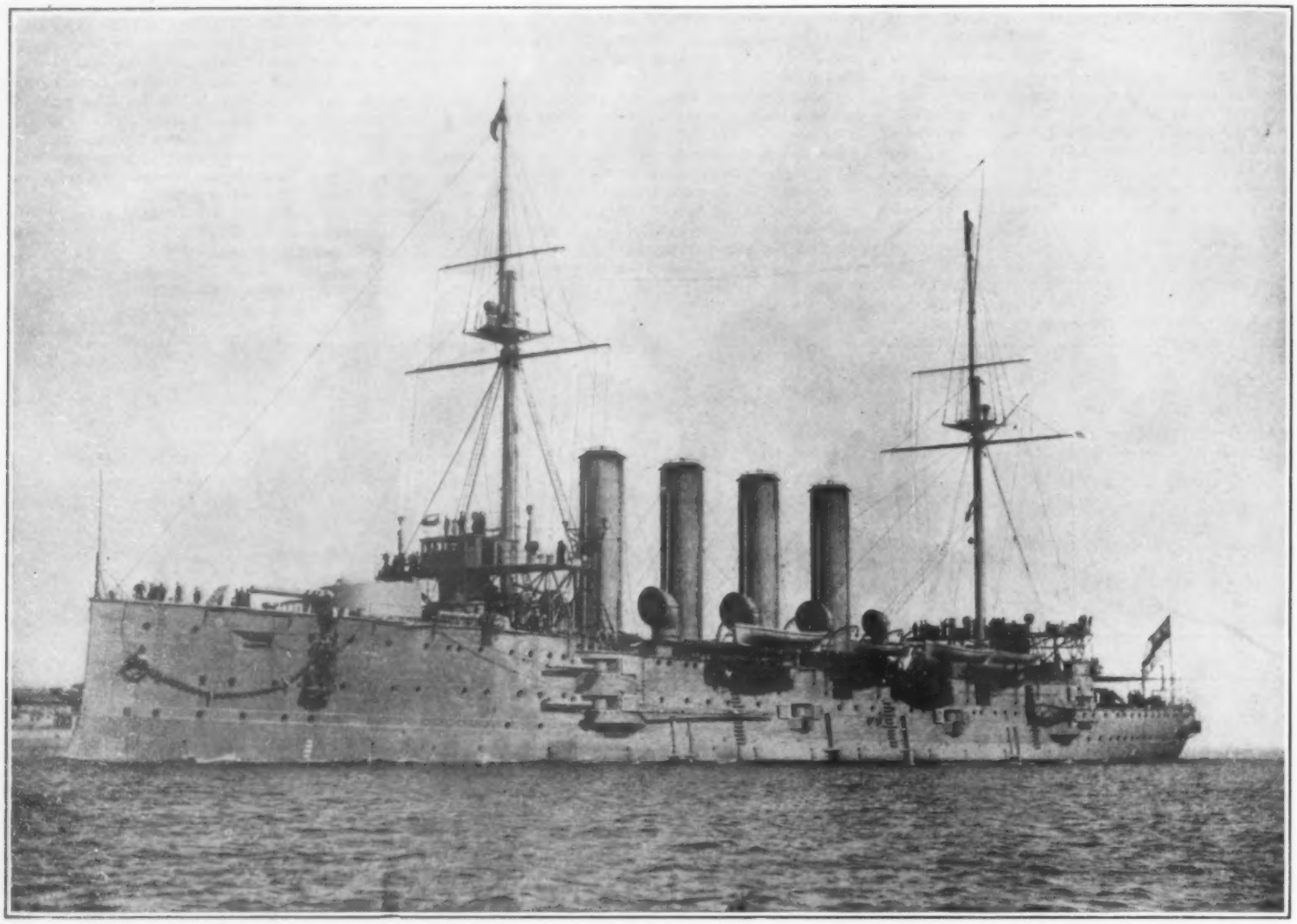
A group of mines for the defense of a harbor channel.



The system of mining used in the Narrows, New York Harbor, during the Spanish War.



The most common type of anchored contact mine is provided with a mechanism which automatically causes the sphere containing the explosive to float at a predetermined depth of about fifteen feet.



British armored cruiser "Aboukir," also "Cressy" and "Hogue," sunk by German submarines in the North Sea.

Date, 1900. **Speed,** 20 knots. **Displacement,** 12,000 tons. **Guns,** two 9.2-inch, twelve 6-inch. **Side armor,** 6-inch.

The Submarine Vindicated

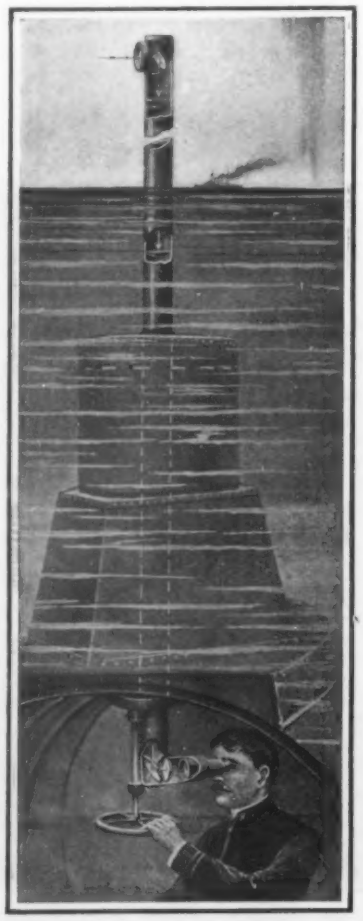
The Sinking of Three Large Cruisers Proves the Deadly Efficiency of Submarine Attack

IT has long been recognized among naval strategists and by the student of naval warfare under modern conditions, that the power which has a great inferiority in battleship strength will retire its capital ships within its own harbors and fortified bases, accepting blockade by the enemy, and seek to reduce his preponderance of strength by mining and by destroyer and submarine attack.

The wisdom of this policy is evident, when we bear in mind the fact that the development of naval war material during the past few decades has been of such a character as to greatly favor the defense and render the work of blockading far more hazardous than it was in the days of sail power and the smooth bore, or even in that period which preceded the successful development of the torpedo and the submarine. The menace of the mine and the submarine is so great that its moral effect upon the blockading fleet is an asset of enormous value to the defense. The only possible protection of the blockading fleet against the submarine is for its ships to keep continually on the move, and if the ships are thus in motion, they are continually exposed to danger of contact with anchored or floating mines. No matter how great may be the watchfulness of the blockading force, there will be conditions of sea and weather which will greatly favor submarine and destroyer attack; and in the course of a long blockade, provided the blockaded fleets are full of resourcefulness and daring, it is inevitable that there will be a loss of ships which, in the course of time, will cut down the numerical superiority of the blockading force.

Very wisely, the German admiralty, in view of the overwhelming strength of the allied naval forces, has adopted a strictly defensive policy, at least so far as its capital ships are concerned. These are doubtless to be found in the various strongly defended harbors of the German coast line, the entrance channels to which are heavily mined, with the mine fields covered by batteries of rapid-fire guns which render it impossible for the enemy to adopt countermining or mine-sweeping operations.

Although the submarine fleet of Great Britain numbered at the outbreak of war seventy vessels, as against twenty-one in commission for Germany, the difference is more than offset by the fact that the German submarines are at liberty to pass out into the high seas and carry on their operations in waters that are free from any obstructions. The British submarines



Observing by means of the periscope.

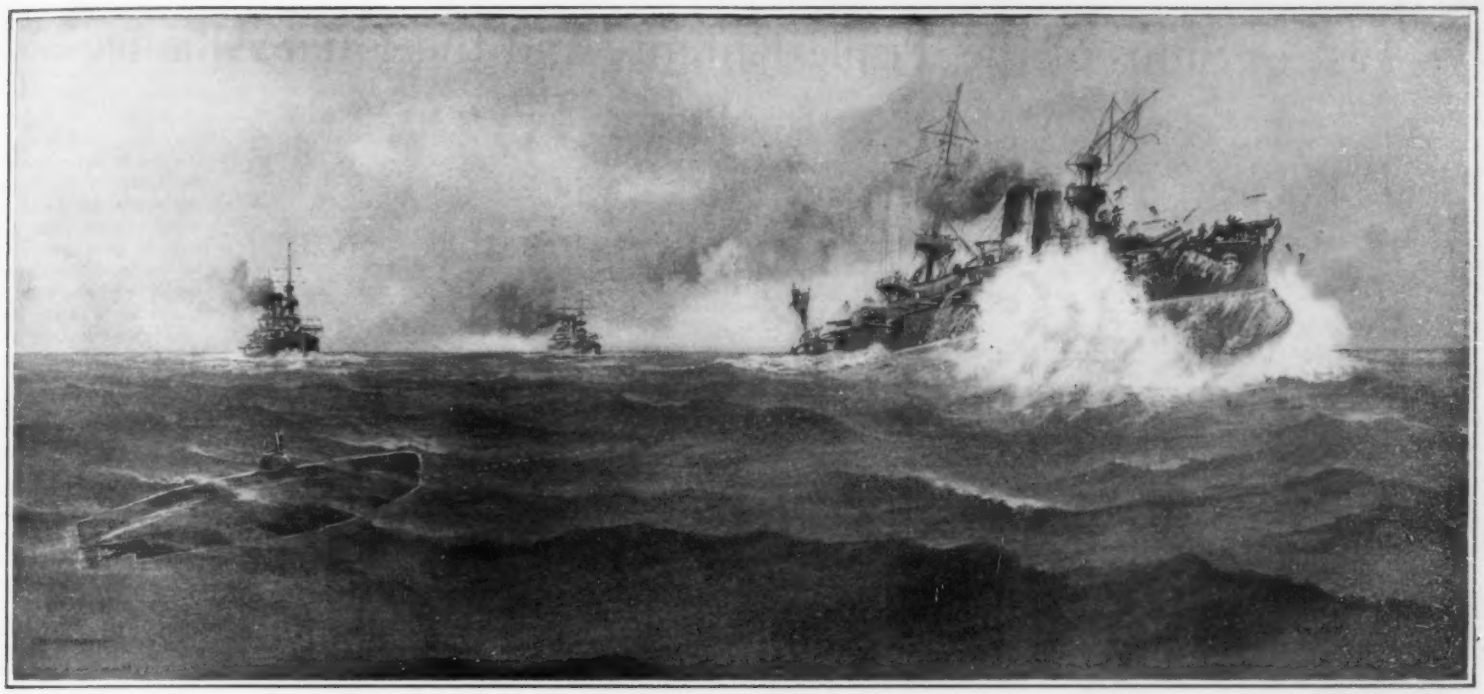
find their way barred by mine fields, heavy steel netting, and various obstructive work of a permanent character, which prevent their entrance to the German harbors and roadsteads. It is true that press reports speak of a British submarine having entered one of the harbors, and sunk the German cruiser "Hela," but this we very much doubt, for the reason that as yet it has received no official confirmation.

Although the German destroyers have, so far, conducted no attack in force against the blockading fleet, it is certain that, from the very declaration of war, the submarines have been cruising at will in the North Sea; and they have at last scored a success, in the sinking of three British armored cruisers of 12,000 tons displacement, which must be recorded as the most brilliant naval success thus far achieved in the present war, and which establishes, at a stroke, the deadly efficiency of this, the latest form of naval warfare.

It is in the moral prestige acquired, rather than in the material loss to the enemy, that the value of this German success is to be estimated. Not only has it shown the wisdom of the defensive tactics adopted by the German admiralty; but it will have a profound effect in provoking a sense of insecurity in the enormous fleet, estimated at some 200 ships, which is holding the German battleship fleet in its home waters.

The "Aboukir" and her sisters, the "Cressy" and "Hogue," are ships of 12,000 tons displacement, mounting two 9.2-inch and twelve 6-inch guns, and protected by a partial belt of 6-inch armor. They were laid down in 1898-1899, and therefore are, in design, about fifteen years old. Hence, they belong to the class of obsolescent vessels, that is, vessels of the reserve, which in a few years time would be struck off the active list. Their best recent speed was from eighteen to twenty knots. Since they belonged to the reserve at the time of the disaster, they were manned by reserve forces. Although their fighting and maneuvering qualities were not comparable to those of the armored ships of the "Minotaur" and "Cochrane" classes, they were fine ships in their day, and were still very serviceable for the patrol duties in which they were engaged at the time of the disaster.

As usual, reports from the English and German side vary greatly. Berlin states that the three ships were sunk by a single submarine, the "U-9"; on the other hand, the survivors of the ship seem to agree that the attack was made by a flotilla of five or more submarines, and that it was well



Successful submarine attack at close range.

planned and deliberately carried out. To an impartial observer the latter would seem to be the true account; and the success of the submarine loses none of its brilliance if we accept the British statement.

Judging from the accounts of the rescued officers, it would seem that the cruisers were accompanied with the usual flotilla of destroyers, thrown around them as a screen against submarine and destroyer attack. The flotilla had left the cruisers about six in the morning, probably to repair to port for coaling, and a relieving flotilla was due to join them later in the day.

Because of its relatively low speed, the submarine is limited in its opportunities of getting near to faster ships that are in motion; and it looks as though the Germans had made use of a rather clever ruse to draw the British ships within range of torpedo attack. The cruisers are reported to have sighted a number of fishing boats which it was discovered were laying mines. They attacked them and immediately the German submarines were reported as approaching from the fishing boat fleet, "the white wake left by the periscopes frothing into view along a wide front." The attack seems to have been boldly carried out, some of the destroyers having their conning towers awash in the earlier phase of the advance. The "Aboukir" was the first cruiser to be torpedoed. The "Hogue" and "Cressy" drew up to rescue the "Aboukir's" crew and were themselves successively torpedoed. It seems to have taken from twenty minutes to less than three quarters of an hour to send the three ships to the bottom. The total loss of officers and men was about 1,600. The survivors claim the attack was so boldly made, that at times the conning towers were exposed at close range, and that two or more of the submarines were struck and probably disabled. Evidence on this point, however, is at present obscure.

The following description of the construction and operation of the submarine will apply in its principles to most of the various types employed in the present war.

The form of the hull is generally described as cigar-shaped. It is built of the very best quality of mild steel, and the workmanship is of the highest order, for the reason that every seam and rivet must be perfectly tight, in view of the service which the boat is called upon to perform. Not only do vessels of this type undergo all the stresses of sea and weather which other vessels are subjected to, but in addition they are required to navigate at considerable depths below the surface of the water. At these depths the pressure of the water is great, so that the hull must be made sufficiently strong to withstand it.

For submerged work large storage batteries are provided, which furnish energy sufficient to drive the boat from ten to eleven knots for a period of over an hour. The same electrical energy will drive her at a lower speed for a much longer time.

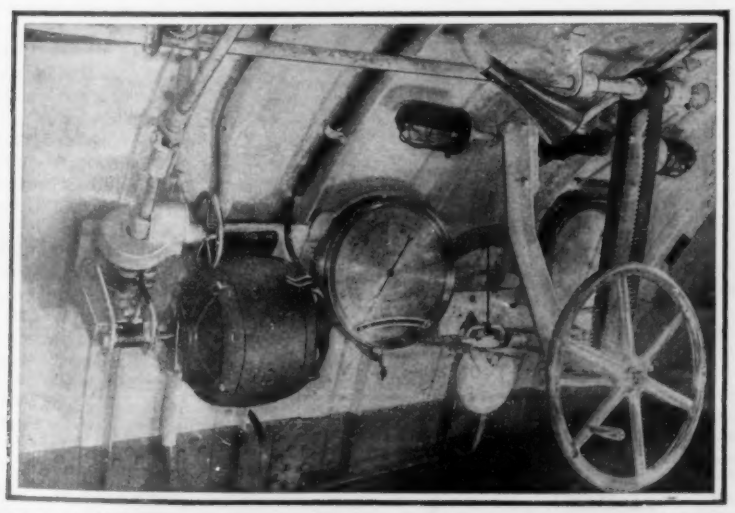
There are two distinct conditions in which the boat may be used. In the first, commonly known as the surface condition, the boat is prepared for cruising. A considerable portion of her hull is above water, a removable navigating bridge is in place, and she is driven by large, powerful, internal-combustion engines. Under these conditions she is managed in about the same way as any vessel built to run upon the surface. As for sea-going qualities, the submarines of our own service have been found in practice to be excellent. In ordinary weather they are fully as comfortable as any surface craft of the same dimensions, and even in the heaviest weather they are entirely seaworthy.

The second distinct condition exists when the boat is submerged. To pass from the surface to the submerged condition, certain valves in the interior of the boat are opened. This allows the water from the sea to run into great tanks built within the boat, and thus virtually sink her. These tanks are closely gaged, so that just the required amount of water is taken in. Under normal conditions, when the boat is at rest with the ballast tanks filled, she will have a few hundred pounds reserve buoyancy, which is represented by the top of her conning tower protruding above the water. If desired, this buoyancy may be entirely destroyed by admitting a small additional amount of water, equal in volume to the volume of that part of the conning tower above water. While in the submerged condition, all communication with the outside atmosphere is necessarily cut off. The crew then breathes the air contained in the body of the boat. The amount of air originally contained within the hull is sufficient to support life with comfort for at least twenty-four hours. But, in addition to the air thus contained, the boat carries a large supply of compressed air in steel flasks, which, if used for breathing purposes, would be sufficient for a number of days.

After having brought the boat to the submerged condition in the manner above described, powerful electric motors are started by throwing in a switch. These motors derive their energy from storage batteries contained in the boat, and drive the propellers. The same storage batteries furnish current for numerous auxiliary motors used for pumping steering, handling torpedoes, etc.

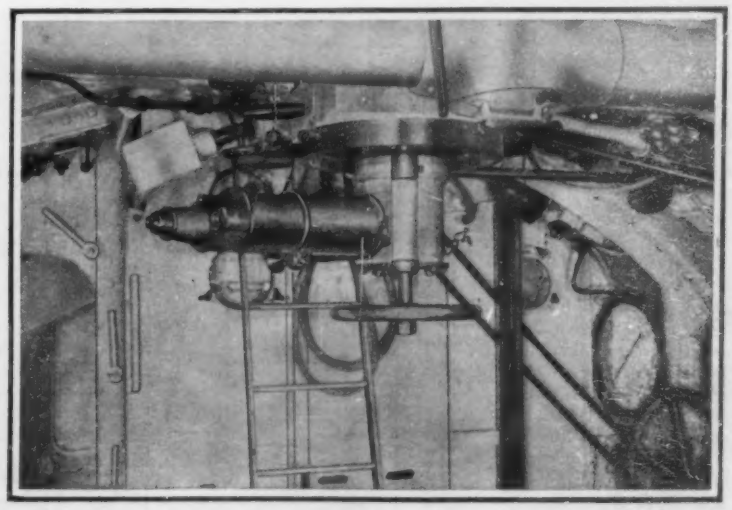
The motion of the boat when under way is controlled by two sets of rudders; one of these sets, known as the vertical rudders, directs the boat's course to port or starboard just as does the rudder of an ordinary ship. In addition, there are provided horizontal rudders, which serve to control the motion of the boat in a horizontal plane; that is to say, the depth at which she runs is regulated by these rudders. For steering in the horizontal plane, instruments are provided, so that the boat may be navigated with the same degree of accuracy as boats on the surface. The first

(Concluded on page 288.)



The hand wheel operates the diving rudders used for steering in a vertical plane. In front of the wheel is a gage whose pointer shows the depth of the boat. The curved dark line below pointer is a spirit level which shows the inclination of the boat.

Diving wheel and depth pressure gage.



This shows the roof, not the floor, of the submarine interior. The horizontal eyepiece and the vertical telescope tube are rotated by means of the hand-wheel whose pinion engages an internal gear ring.

Eyepiece at bottom of periscope.

THE INTERIOR OF A MODERN SUBMARINE

List of Ships of the Triple Entente and the Dual Alliance

Probable Additions of New Ships During the Ensuing Six Months

THE accompanying list of the ships in active commission in the various fleets now engaged in the Great War of the Nations is complete to September 1st, 1914. Vessels that have been sunk or been driven to neutral ports since the opening of the war have been omitted. These include for the British fleet, the scout cruisers "Aboukir," "Cressy," and "Hogue," sunk by submarine attack, and for Germany, the scout cruisers "Koln" and "Mainz," and the cruiser "Ariadne," and two torpedo-boat destroyers lost in the engagement of August 28th, at the mouth of the Elbe; the scout cruiser run aground and blown up in the Baltic, the battle-cruiser "Goeben," and the scout-cruiser "Breslau," which have been driven to the Dardanelles—neutral waters. The tables give the date of launch and the displacement of the battleships, and the speed and displacement of the cruisers.

It will be understood that at any time, and even before these tables are published, for which we are indebted to Brassey, a great naval battle may necessitate the revision of these lists. But since the names of vessels that may be lost will be published in the various official bulletins, the reader will be able to make the necessary eliminations from the tables as thus presented.

At present the situation is such that most of the powers are in a position to complete at their various protected naval bases and shipbuilding establishments, the vessels which were under construction when the war opened. England, having the full command of the sea, will be quite unhindered in this work; Germany, moreover, with her naval bases and government shipbuilding yards strongly protected by fortifications, mines, etc., is able to do the same, and probably will be able to pursue her shipbuilding policy unhindered for some months to come. France is in a similar position, and Austria and Russia, though opposed by overwhelming naval forces, are not as yet under fire from the sea nor are their shipbuilding plants seriously threatened by land forces.

The ships which are completed and available for service are shown in the tables in Roman type. Those that are not completed are shown in italics. The latter ships, which will be completed within the next three months are designated by an asterisk and those which will be completed within the next six months are indicated by a single dagger.

We find then, that in the dreadnought class, by December 1st, the British fleet will be increased by the addition of the "Queen Elizabeth" and the "Warspite" and by the first of March by the addition of the "Malaya," the "Barham," and the "Valiant." All five of these ships are similar. They are of 27,500 tons displacement, and they are notable as being the first dreadnoughts to mount the 15-inch gun, of which they will carry eight in four turrets on the center line. The 15-inch gun fires a shell weighing 1,925 pounds, which is discharged with a muzzle velocity of 2,500 feet per second and a muzzle energy of 83,500 tons. The gun weighs 98.6 tons, and it is enormously superior at 10,000 yards to anything afloat to-day. Another remarkable feature of these ships is that they will have a speed of over 25 knots. Their belt armor will be from 13 to 14 inches in thickness, and this combination of qualities will enable them to overtake a fleeing dreadnought fleet, and by engaging the vessels at the rear of the line, force the enemy to accept a fleet action. In the scout class, Great Britain will add by December 1st, seven vessels of the type of the "Arethusa," which was engaged in the recent fight at the mouth of the Elbe. These ships mount two 6-inch and six 4-inch guns and carry four torpedo tubes for the 21-inch torpedo. The speed is 30 knots. By March 1st Great Britain will have added two more of this class.

France, by March 1st, will be able to add to her fleet the "Provence" and "Bretagne," vessels of 23,550 tons and 21 knots speed, mounting ten 13.4-inch guns and protected by a 10¾-inch belt.

Russia, by March 1st, will have completed her first two dreadnoughts, "Gangut" and the "Poltava," 23,000 tons and 23 knots speed, each

TORPEDO FLOTILLAS.

Class.	GREAT BRITAIN.			GERMANY.			AUSTRIA-HUNGARY.			FRANCE.			RUSSIA.		
	Built.	Building.	Total.	Built.	Building.	Total.	Built.	Building.	Total.	Built.	Building.	Total.	Built.	Building.	Total.
Destroyers	218	20	238†	142‡	10	152¶	19	..	19	83	4	87	105	36	141
Torpedo Boats,* 1st and 2nd Class	70	..	70	47	..	47	58	27	85	153	..	153	25	..	25
Submarine Boats	76	20	96	27§	12	39	10	4	14	70	23	93	25	18	43

* Excluding boats over 20 years old. †12 projected. ‡2 sunk. §1 sunk. ¶12 projected.
Three British Dominion destroyers built, three under construction; two Dominion submarines.

TABLE I.—MODERN BATTLESHIPS.

GREAT BRITAIN. Launched.	Name.	Displacement.
		tons.
	Royal Sovereign	25,750
	Royal Oak	
	Revenge	
	Resolution	
	Ramilies	
	Malaya†	
	Barham†	
1913	*Queen Elizabeth**	27,500
1913	*Warspite**	
	Valiant†	
1912	Iron Duke	25,000
1912	Marlborough	
1913	Emperor of India	
1913	Benbow	
1911	King George V	23,000
1912	Ajax	
1912	Audacious	
1911	Centurion	
1911	Conqueror	
1911	Monarch	22,500
1911	Thunderer	
1910	Orion	
1910	Colossus	20,000
1910	Hercules	
1909	Neptune	19,900
1908	Collingwood	
1908	St. Vincent	19,250
1909	Vanguard	
1907	Bellerophon	
1907	Temeraire	18,600
1907	Superb	
1906	Dreadnought	17,900
1906	Lord Nelson	16,500
1906	Agamemnon	
	34 ships	772,600

GERMANY. Launched.	Name.	Displacement.
		tons.
	Ers. K. Fried. III	29,000
	Ers. Worth	
	T	
1914	*Kronprinz*†	
1913	*Grosser Kurfurst**	26,575
1913	*Markgraf**	
1913	*Konig**	
1911	Kaiserin	
1912	Konig Albert	
1912	Prinz Luitpold	24,310
1911	Friedrich der Grosse	
1911	Kaiser	
1910	Oldenburg	
1909	Thuringen	22,500
1909	Ostfriesland	
1909	Helgoland	
1908	Posen	
1908	Rheinland	18,600
1908	Nassau	
1908	Westfalen	
	20 ships	479,250
	RUSSIA.	
	Ekaterina II	
1914	*Alexander III*	22,500
1913	*Imperatritsa Maria*	
1911	*Sevastopol*	
1911	*Petroparlosk*	23,000
1911	*Gangut*†	
1911	*Poltava*†	
1907	Imperator Pavel I	17,400
1906	Andrei Pervozvannyi	
	9 ships	194,300

AUSTRIA-HUNGARY. Launched.	Name.	Displacement.
		tons.
1911	Viribus Unitis	20,000
1912	Prinz Eugen	
	Szent Istvan	
1912	Tegetthof	
	4 ships	80,000
	FRANCE.	
	Bearn	24,830
	Languedoc	
	Flandre	
	Gascogne	
	Normandie	
1913	*Bretagne*†	23,177
1913	*Lorraine*	
1913	*Provence*†	
1912	France	23,180
1912	Paris	
1911	Courbet	
1911	Jean Bart	
1909	Danton	18,028
1909	Condorcet	
1909	Diderot	
1909	Mirabeau	
1910	Vergniaud	
1909	Voltaire	
	18 ships	294,249

* Completed in three (3) months. †Completed in six (6) months.

TABLE II.—BATTLE-CRUISERS.

GREAT BRITAIN. Launched.	Name.	Displacement.
		tons.
1913	Tiger	28,600
1912	Queen Mary	27,000
1911	Princess Royal	26,350
1910	Lion	
1911	New Zealand	18,800
1911	Australia	
1909	Indefatigable	18,750
1907	Indomitable	
1907	Inflexible	17,250
1907	Invincible	
	10 ships	216,400

GERMANY. Launched.	Name.	Displacement.
		tons.
	Ers. Vict. Luise	30,000
	Ers. Hertha	
1913	Derfflinger	
1913	*Lutzow*	24,640
1912	Seydlitz	22,640
1910	Moltke	18,700
1909	Von der Tann	
	7 ships	185,980

RUSSIA. Launched.	Name.	Displacement.
		tons.
	Borodino	32,200
	Ismail	
	Nazarin	
	Kinburn	
	4 ships	128,800

TABLE III.—OLDER BATTLESHIPS.

GREAT BRITAIN. Launched.	Name.	Displacement.
		tons.
1903	Edward VII	16,350
1903	Commonwealth	
1903	Dominian	
1903	Hindusten	
1904	Zealandia	
1905	Africa	
1904	Britannia	
1905	Hibernia	
1903	Swiftsure	11,800
1903	Triumph	
1902	Queen	15,000
1902	Prince of Wales	
1901	Albemarle	
1901	Cornwallis	
1901	Duncan	14,000
1901	Exmouth	
1901	Russell	
1898	Formidable	
1898	Irresistible	
1899	Implacable	15,000
1899	London	
1899	Venerable	
1899	Bulwark	
1897	Canopus	
1899	Glory	
1898	Albion	12,950
1898	Goliath	
1898	Ocean	
1899	Vengeance	
1894	Magnificent	
1895	Majestic	
1895	Prince George	
1895	Victorious	
1896	Cæsar	14,900
1896	Hannibal	
1896	Illustrious	
1895	Jupiter	
1896	Mars	
	38 ships	556,200

GERMANY. Launched.	Name.	Displacement.
		tons.
1904	Deutschland	13,040
1905	Hannover	
1905	Pommern	
1906	Schlesien	
1906	Schleswig-Holstein	
1902	Braunschweig	
1903	Elsass	
1903	Hessen	12,997
1903	Preussen	
1904	Lothringen	
1900	Wittelsbach	
1901	Wettin	
1901	Zahringen	11,643
1901	Mecklenburg	
1901	Schwaben	
1896	Kaiser Friedrich III	
1897	Kaiser Wilhelm II	
1899	Kaiser Wilhelm der Grosse	10,974
1900	Kaiser Barbarossa	
1899	Kaiser Karl der Grosse	
	20 ships	243,270
	RUSSIA.	
1906	Ioann Zlatoust*	12,733
1906	Evstafi*	
1903	Slava	13,516
1901	Cesarevitch	12,912
1900	Panteleimon*	12,582
1893	Tria Sviatitelia*	13,318
	6 ships	77,794

AUSTRIA-HUNGARY. Launched.	Name.	Displacement.
		tons.
1908	Erz. Franz Ferdinand	14,226
1909	Radetzky	
1910	Zrinyi	
1904	Erz. Friedrich	10,433
1903	Erz. Karl	
1905	Ferdinand Max	
1901	Arpád	8,208
1902	Babenberg	
1900	Habsburg	
	9 ships	98,601
	FRANCE.	
1903	Patrie	14,635
1902	République	
1904	Justice	
1907	Vérité	
1904	Démocratie	
1899	Suffren	12,527
1896	Bouvet	12,007
1895	Massena	11,735
1896	St. Louis	11,090
1896	Gaulois	11,105
1895	Charlemagne	11,108
1894	Carnot	11,954
1899	Henri IV	8,807
	13 ships	163,508

* Black Sea.

mounting twelve 12-inch guns, in four three-gun turrets, the ships being protected by 9 inches of side armor.

Germany, before the close of the present year, should she preserve her seaboard intact, should be able to add three powerful dreadnoughts to her fleet; the "Markgraf," the "Grosser Kurfurst," and the "Koenig," vessels of 25,500 tons displacement and 21.5 knots speed, protected by 14-inch side armor and mounting ten 12-inch guns and fourteen 6-inch guns. These vessels are being built at Bremen, Hamburg, and Wilhelshaven, respectively. Before the close of the year, Germany should add to her fine fleet of fast scout-cruisers the "Regensburg" and "Graudenz" of 27½ knots speed and 5,000 tons displacement, which are protected by a 4-inch belt and mark twelve 4-inch guns, and two 20-inch torpedo tubes. By the first of March they should have two additional ships of this class, the "Gefion" and "Hela," ready for service.

All of the navies engaged in the war have a greater or less number of destroyers and submarines under construction, and all of them will doubtless make every effort that the exigencies of the war will permit to complete these craft and put them afloat. Great Britain and Germany, because of their large facilities, will make undoubtedly a considerable increase, but it is impossible to predict how many of these craft, and when, will be completed in the earlier months of the war.

The Fur-seal Industry of Alaska

FOR many years questions relation to the killing of fur seals in the seal islands of Alaska have been before various departments of the Government, and had their origin in the killing in open water by subjects of other nations of fur seals which, although breeding on the islands mentioned, spend most of their time in the water in search of food and in annual migrations. The interest of the Government lay mainly in the fact that they bred in the territory of the United States, and their pelts were highly valuable; and in 1870 their breeding place in Alaska was made a reservation, and their killing was subject to strict regulations as to the sex, age, and the number that could be killed. As the sexes are born in about equal numbers it was recognized that such males as were not necessary for breeding purposes might be killed on land without injury to the species, and therefore the killing on land of all females was prohibited, and a stipulated number of the males might be killed if above one year old. Enterprising persons soon discovered that the laws did not protect the seals when the latter went into the ocean to feed or when they undertook their annual migrations from the breeding place to waters as far south as California. It was found also that these seals could be pursued and captured easily in the water. The killing of these animals in the water, unlike the killing of them on land in a well-regulated manner, involved a deadly menace to the species, for the reason that the water catches comprised from 50 to 85 per cent of females, while the land killing carefully excluded females. After many efforts treaties were concluded with Great Britain, Japan, and Russia under which sea killing was prohibited for fifteen years, and in all of the negotiations leading up to these treaties it was the contention of the United States Government, and admitted by the other nations, that the killing of breeding females in the sea, and not the killing of surplus males on land, was the cause of decrease in seal life; and these conclusions were apparently fully established by all independent investigators and scientific observers who have visited the seal island and studied the subject, and the results of the suspension of sea killing has apparently verified the findings.

Charges of fraud, corruption and negligence on the part of the Government employes and the lessees of the sealing rights on the Pribilof Islands having been made before Congress a committee was appointed to investigate the charges; and most of the testimony appears to have been directed to show that the diminishing numbers of seals has been due to the indiscriminate killing of the seals on land, and that great numbers of female and yearling seals have been taken by the lessees, contrary to law and their agreements. As a result of the investigations the person who was mainly instrumental in bringing the charges was sent to Alaska by the committee for the purpose of investigation; and a reopening of the investigation has been ordered.

A minority of the Congressional Committee in charge of the matter has however presented a report that takes exception to the action of the majority, and in it they point out that the testimony taken does not substantiate the charge that female seals were killed right and left, but that it was intended to relate to the killing of yearlings, the sex of which it has been asserted cannot be distinguished. Much conflicting testimony was taken on this question, and while the minority report contends that the charges were disproved by evidence of a reliable character, the majority of the committee has ruled for a reopening of the case, which apparently means little more than a repetition of the testimony already taken.

TABLE IV.—FIRST-CLASS CRUISERS.

GREAT BRITAIN.			GERMANY.			AUSTRIA-HUNGARY.		
Speed.	Name.	Displacement.	Speed.	Name.	Displacement.	Speed.	Name.	Displacement.
knots.		tons.	knots.		tons.	knots.		tons.
22½	Minotaur	14,600	23	Blücher	15,550	22	St. Georg	7,185
22½	Shannon		22½	Scharnhorst	11,420		1 ship	7,185
22½	Defence		22½	Gneisenau				
23	Duke of Edinburgh	13,550	21	Roon	9,350			
23	Black Prince		21	Yorck				
23	Achilles		20½	Prinz Adalbert	8,858			
23	Cochrane		20½	Friedrich Karl				
23	Natal		20½	Prinz Heinrich	8,759			
23	Warrior		19	Fürst Bismarck	10,570			
22¼	Devonshire	10,850		9 ships	94,135			
22¼	Antrim							
22¼	Argyll							
22¼	Carnarvon							
22¼	Hampshire							
22¼	Roxburgh							
23	Monmouth	9,800		RUSSIA.			FRANCE.	
23	Kent							
23	Essex							
23	Berwick					23	Edgard Quinet	13,780
23	Cornwall					23	Waldeck-Rousseau	
23	Cumberland					23	Ernest Rénan	13,427
23	Donegal					23	Jules Michelet	12,370
23	Lancaster					22	Leon Gambetta	12,351
23	Suffolk		21	Rurik	15,170	22	Jules Ferry	
23	Drake	14,100	22	Adm. Makaroff	7,900	22	Victor Hugo	
23	Good Hope		21	Bayan		21	Condé	
23	King Alfred		21	Pallada		21	Gloire	
23	Leviathan		20	Gromobol	13,220	21	Marseillaise	9,856
21	Bacchante	12,000	20	Rossia	12,130	21	Admiral Aube	
21	Euryalus					21	Gueydon	
21	Sutlej					21	Montcalm	9,367
20¾	Amphitrite	11,000				21	Dupetit Thouars	
20¾	Argonaut					21	Jeanne d'Arc	11,092
20½	Europa	11,000				21	Desaix	
20½	Niobe					21	Dupleix	7,578
						21	Kleber	
	35 ships	414,800		6 ships	64,220		18 ships	191,761

TABLE V.—LIGHT CRUISERS.

GREAT BRITAIN.			GERMANY.			AUSTRIA-HUNGARY.		
Speed.	Name.	Displacement.	Speed.	Name.	Displacement.	Speed.	Name.	Displacement.
knots.		tons.	knots.		tons.	knots.		tons.
30	*Calliope*	3,800	27½	*Ers. Gazelle*	5,000	19	K. Maria Theresia	5,187
30	*Conquest*		27½	*Ers. Niobe*		20½	Karl VI	6,151
30	*Cordelia*†		27½	*Ers. Gefion*†		26	Admiral Spaun	
30	*Carysfort*		27½	*Ers. Hela*†		27	*Saida**	3,500
30	*Cleopatra*		27½	*Regensburg**		27	*Helgoland**	
30	*Comus*		27½	*Graudenz**		27	*Novara*†	
30	*Carolina*†		27	Karlsruhe	4,820	20	Aspern	2,362
30	*Champion*		27	Rostock		20	Szigetvar	2,313
30	Arethusa		27	Stralsund	4,500	20	Zenta	2,264
30	Aurora		27	Strassburg			9 ships	32,277
30	Galatea		21	Kaiserin Augusta	5,956			
30	Inconstant	3,750	19½	Freya	5,569			
30	Penelope		19½	Hertha				
30	Phaeton		19½	Victoria Luise				
30	Royalist		19½	Hansa	5,791			
30	Undaunted		19½	Vineta				
26	Birmingham	5,400	27	Augsburg	4,280			
26	Lowestoft		25½	Kolberg	4,234			
26	Nottingham		24½	Emden	3,544			
26	*Brisbane*		24½	Dresden				
25½	Chatham	5,400	23½	Stuttgart	3,396			
25½	Dublin		23½	Nurnberg				
25½	Southampton		23½	Stettin	3,346			
25½	Melbourne		23	Konigsberg				
25½	Sydney		23	Bremen	3,200			
24¾	Dartmouth	5,250	23	Hamburg				
24¾	Falmouth		23	Berlin				
24¾	Weymouth		23	Munchen				
24¾	Yarmouth		23	Lubeck				
25	Bristol	4,800	23	Leipzig	2,657			
25	Glasgow		23	Danzig				
25	Gloucester		21½	Frauenlob				
25	Liverpool		21½	Arcona				
25	Newcastle		21½	Undine				
19¾	Crescent	7,700	21	Medusa	2,618			
20	Edgar	7,350	21	Nymphe				
20	Endymion	7,350	21	Amazone				
19¾	Gibraltar	7,700	21½	Thetis	2,603			
20	Grafton	7,350	21	Gazelle				
20	Hawke	7,350	21	Niobe				
19¾	Royal Arthur	7,700		40 ships	159,070			
20	Theseus	7,350						
19½	Diana	5,600						
19½	Dido							
19½	Doris							
19½	Eclipse							
19½	Isis							
19½	Juno							
19½	Minerva	5,600						
19½	Talbot							
19½	Venus							
19	Furious	5,750						
19	Vindictive							
20	Hermes	5,600						
20	Highflyer							
20	Hyacinth							
21	Challenger	5,880						
21	Encounter							
25	Fearless	3,440						
25	Active							
25	Blonde							
25	Blanche	3,350						
25	Bellona							
25	Boadicea	3,300						
23	Amethyst							
22	Diamond	3,000						
22	Sapphire							
22	Topaze							
19½	Astræa	4,360		RUSSIA.				
19½	Charybdis							
19½	Fox						FRANCE.	
19½	Hermione							
20	Sappho	3,400	27½	*Admiral Grieg*	7,600			
19	Philomel	2,575	27½	*Svietlana*				
20½	Pelorus	2,135	27½	*Admiral Boutakoff*		19	D'Entrecasteaux	7,995
20	Proserpine		27½	*Admiral Spiridoff*		23	Guichen	8,151
20	Pegasus		27½	*Admiral Lazareff*		23	Châteaurenault	7,898
20	Pyramus		27½	*Admiral Nakhimoff*		18	Brulx	4,735
20	Pioneer	2,200	20	Aurora	6,731	19	Pothwau	5,374
20	Psyche		23	Askold	5,905	23	Jurien de la Gravière	5,595
25	Adventure	2,670	23	Bogatyr	6,675	20	Lavoisier	2,285
25	Attentive		23	Kagul		20½	D'Estrées	2,421
25	Foresight	2,850	23	Pamyat Mercuria		19¼	Friant	3,882
25	Forward		23	Oleg		19	Descartes	3,970
25	Patrol	2,940	27½	*Admiral Nereiskoi*	4,300	19	Cassard	3,890
25	Pathfinder		27½	*Mouravieff Amoursky*		19	Du Chayla	3,890
25	Sentinel	2,895	19	Almaz	3,285			
25	Skirmisher		23	Jemtchug	3,106			
	88 ships	396,000		16 ships	99,927		12 ships	60,086

* Completed in three (3) months. † Completed in six (6) months.

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Royal British field artillery in action.

Photograph by Paul Thompson.

A French bicycle corps with its collapsible bicycles.

Removing Rubens' masterpiece, "Assumption of the Virgin," from Antwerp Cathedral, to be hidden.

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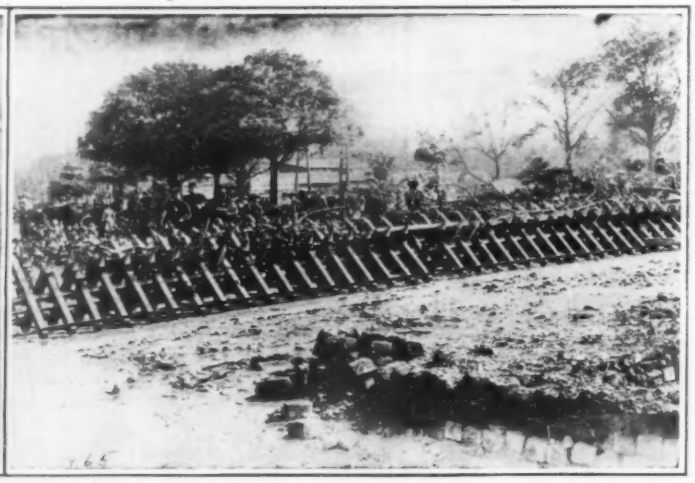
Termonde's beautiful gateway. It was destroyed by the Belgians themselves, to provide an unobstructed fire for their guns.

Photograph by Paul Thompson.

German infantry in a natural trench.



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An obstacle outside Paris in anticipation of a German advance.

Germans constructing temporary bridge.

PICTURES FROM THE FRONT

German Fleet Steaming in

ing in Battle Formation

Belgian soldiers digging trenches on the outskirts of Malines.

A British cyclist machine gun battery.

Dummies used during maneuvers by German army for rifle practice.

A German bomb-proof.

A French motorcar equipped with a machine gun.

Bridge at Argentau, blown up by the Belgians to impede the Germans.

German cavalry crossing a stream. The horses propel the boat.

PICTURES FROM THE FRONT

The Municipal Theater of Santiago, Chile.

Avenida Rio Branco, Rio de Janeiro, Brazil.

Our Latin American Opportunity

An El Dorado for Our Business Men

By John Barrett, Director General of the Pan-American Union, Formerly U. S. Minister to Siam, Argentina, Panama and Colombia

IF Latin America will be approached by all those who wish to engage in its material evolution in the same way that the opportunities in the United States and Canada have been approached, with the corresponding victories and defeats, successes and disappointments, there is no reason why there should not be a development during the next ten years in these southern nations which will bring not only greatly added prosperity to their peoples, but satisfactory rewards to the engineers and investors of the United States and Europe who co-operate in the right spirit with them.

For many years the Pan American Union, which is the international organization of the twenty-one independent American republics, maintained in Washington for the development of commerce, intercourse, friendship and peace among them all, has been carrying on without ceasing a propaganda to educate the people of the United States regarding the Latin American countries, and, in turn, to inform Latin America concerning this country. There are no better instrumentalities for the advancement of both confidence and commerce, of good understanding and trade, than the spread of useful and reliable information about each country among all the others. The better they know each other, their resources, their potentialities and their peoples, the more will they be desirous of promoting exchange of commerce and always preserving peace and prosperity throughout the Western Hemisphere. In response to this constant agitation of the Pan American Union there has been a gradual growth of interest in each American republic about the others, and especially in the United States about its sister American nations, which has been gratifying and encouraging.

Effect of the War on Latin America.

It has remained, however, for a great misfortune in the relations of nations to center an extraordinary and special interest in Latin America. The European war, which is perhaps the most deplored combat in the history of the world, has unexpectedly emphasized to the Western Hemisphere the present onward movement and the future possibilities of each of the Latin American countries, not only in commerce, but in everything that pertains to material, economic and social advancement. Although a larger number than is generally appreciated of our manufacturers, exporters, importers, bankers, travelers, and students of the world's progress had already developed close acquaintance with Latin America, which was bringing splendid results, still the great majority of people in the United States required some extraordinary event like the European war to turn their attention to the southern republics.

To get a proper appreciation of Latin America certain fundamental facts must be borne in mind. "Latin America" is a comprehensive term. It includes all of the countries from the Rio Grande and Straits of Key West south to the Straits of Magellan. "Spanish America," a term often misused, does not include Brazil, which has the largest area and population of any country in Latin America. It also excludes Haiti, which, though small, is potential in the commerce and development of the lands of the Caribbean Sea. In discussing Latin America, however, the average man in the United States must not make the cardinal error of overlooking the individuality of each one of these countries. If he is speaking of Argentina alone, he must not call that a Latin American land or its population "Latin Americans." He should refer to the country invariably as "Argentina" and to the people as "Argentines." In mentioning the Brazilians they should not be called "Portuguese Americans," but "Brazilians." In considering Chile, it should not be described as a Spanish American or South American country of the West Coast, but distinctively as "Chile," and it should be remembered that the "Chileans" are just as proud of being called by that name as peoples of the lands of Europe are anxious to be called "Englishmen," "Frenchmen," "Germans," etc.

There has been too much of a tendency in the past to call all the peoples south of the United States "Latin Americans," as if they all had the same history, the same characteristics and the same possibilities! The truth is that almost every one of these twenty countries has its individual characteristics as distinctive as those of the United States. When the commercial man, the engineer or the traveler visits these countries, he should always bear this fact in mind if he would win the appreciation, interest and confidence of the peoples with whom he is attempting to do business or associate. Closely allied to this thought is the necessity of the avoidance by all men from the United States, when visiting the southern countries and peoples, of an air of patronage, or of suggestion that these lands are in any way behind the United States in progress or dependent upon the United States for their prosperity and development. If any such suggestion is to be made, it should come from their peoples rather than those of this country.

Latin America in North America.

In studying Latin America it also should be noted at the very outset that there are signal geographical differences with corresponding segregation of interests, of commerce, and of opportunities. The average superficial observer should not forget that there are ten Latin American countries which are not in South America, but practically a portion of the North American continent. Mexico, the five Central American countries of Guatemala, Salvador, Honduras, Nicaragua, and Costa Rica, together with Panama, Cuba, the Dominican Republic, and Haiti, are distinctively, from a geographical and commercial standpoint, North American. The commercial and financial transactions of all these ten countries are greater with the United States than they are with Europe. In this same group also could be classed two of the countries of the South American continent; namely, Colombia and Venezuela. Both of these countries, for example, exchange more products with the United States than they do with any individual European country. In considering, therefore, the subdivisions of Latin America, there might be placed in one division these twelve countries just named, not only because of their commercial and financial relationship, but because of the fact that they are nearer by routes of transportation to the principal ports of the United States than they are to the principal commercial *entrepôts* of Europe. Colombia and Venezuela, inasmuch as they are in South America proper, seem more remote than they really are. The distance from the most northern points of those two countries to Key West is less than the distance from New York city to Kansas City.

These lands that border on the Gulf of Mexico and the Caribbean Sea present to the United States vast fields of commercial and financial activity. Some of them have already made remarkable progress and are conducting a rapidly growing trade, but the majority of them need an abundance of money to be invested in all kinds of material enterprises in order that they may enter upon a great progressive advancement. The so-called difficulties of revolutions and instability of government must not be exaggerated to the extent that there will not be a realization of their enormous natural resources. Although unfortunate conditions may have obtained, for instance, for some time in Mexico and in one or two of the Central American and other Caribbean lands, it is the firm belief of those of us who have studied the field for long years that these unfortunate conditions are simply the darkness before the dawn, and that during the next ten years there is going to be a new material and commercial era in all of them which will astonish the world. These twelve countries represent a combined population of thirty millions, and they already conduct an annual foreign trade valued at approximately $700,000,000. In this trade the United States is increasing its transactions much faster than is any country of Europe, notwithstanding a prevailing impression to the contrary. It is, therefore, logical that if these twelve countries or their contributory coasts are conducting this foreign business just as the Canal is opening, they should in another ten years increase it to $1,000,000,000 and more, with corresponding advantage to them and the United States.

The Influence of the Panama Canal.

The significance and value of the Panama Canal must always take into consideration these twelve countries, which, as it were, are on the way to the Canal. Usually in discussing the Panama Canal there is thought only of what is beyond the Canal in the Pacific Ocean. If a bridge is built across a great river connecting two important cities or localities, the neighborhood approaching the bridge benefits and is built up as well as the neighborhood beyond it. The Panama Canal is a mighty water bridge between the Atlantic and the Pacific, and it will benefit the Latin American countries tributary to the Atlantic just as much as it will the Latin American countries tributary to the Pacific Ocean. Already every port of this group of countries bordering on the Caribbean and Gulf has commenced to feel the impulse of the new commerce and travel which the Panama Canal is helping to develop. By the Panama Canal they have been taken from a great ocean pocket, as it were, and placed upon a mighty world ocean route. They are all so near to the Atlantic and Pacific coasts of the United States that to-day a commercial represen-

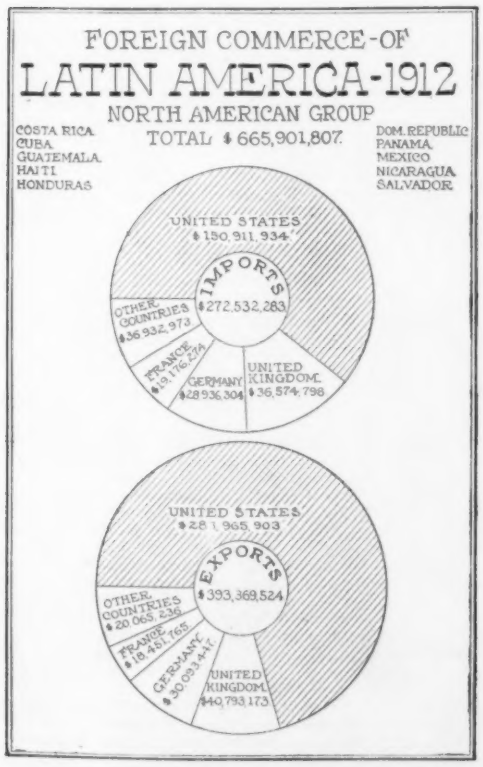
tative, engineer, investor, or traveler from the United States can easily visit their principal ports and return within a month's time.

The next phase and segregation of Latin America to study with reference to commerce, investment, constructive engineering, etc., is its western coast, now reached directly through the Panama Canal, which extends from, approximately, San Diego, California, in a southeasterly direction 8,000 miles to the Chilean port of Punta Arenas on the Straits of Magellan. That this remarkable coast line, which could only be approached prior to the opening of the Panama Canal by vessels sailing from the Gulf and Atlantic ports of the United States in a journey of 30 to 50 days, is most resourceful and potential is proved by the fact that its countries, either in their entirety or in their sections tributary to the Pacific, have a population of twenty millions and have been conducting, without the Canal, an annual foreign commerce valued in excess of $600,000,000. If they were able to conduct this trade in their former isolation, it is safe to predict that they will build it up to $1,000,000,000 within the next ten years. While formerly the United States was at a great disadvantage in this commerce, it should now, by using the Canal, gain a satisfactory share of it.

The West Coast of Latin America.

It is not possible within the limits of this article to analyze carefully the commercial, material, economic, and engineering possibilities of each one of the twelve countries or their coast lines tributary to the Pacific, but certain interesting conditions and potentialities should be emphasized. From long familiarity with these countries, their geographical formation and their resources, I do not share the contention of many persons that they do not offer a specially inviting field for capital and commerce. It is to be admitted that the average traveler who goes up and down the West Coast of Latin America to-day sees much that is forbidding and discouraging in the vast extent of unwatered and unforested plateaus and mountains. This was true, however, of those who first looked upon the shores of much of the Pacific Coast of the United States. There has been such an extraordinary development in the arid portions of California, Oregon, and Washington through irrigation, the harnessing of water power, the building of railroads and the employment of modern methods of agriculture and industry, that there is good reason to believe that the corresponding sections of Mexico, Central America, Colombia, Ecuador, and Peru, Bolivia, and Chile will experience a like progress and prosperity when similar methods have been employed in them.

What already, moreover, has been done and is being done in such a remarkable land as Chile is strong evi-



The trade of the Latin North American republics.

dence of a great future. Chile, located almost entirely in the south temperate zone, has a Pacific Coast line which has nearly double the frontage on the ocean that the United States proper has, not including Alaska; and it has the same diversity of climate and resources! Covering an area nearly equal to that of California, Oregon, and Washington combined, or more than that of Texas, it is improving its ports and building railroads from them into the interior, which, in turn, are being connected by a great longitudinal line. All this construction is transforming its economic development. From the forested and fertile areas of the south to the arid nitrate sections of the north, Chile is entering upon a new life which must receive a fresh impulse from the opening and use of the Canal.

The vast interior country of Bolivia, with an area double that of the State of Texas; the long reach of Peru, with a coast line on the Pacific equal to the whole Atlantic Coast line of the United States from Maine to Georgia; the lesser, but resourceful area of Ecuador, all tributary to the Pacific; and the western coast of Colombia—the only South American land which has an extensive coast on both the Atlantic and Pacific—and its sister land of Venezuela likewise, through the construction of railways, the exploitation of their mineral resources and the development of agriculture by irrigation, form an inviting field of opportunity.

In considering the future of the western Latin American countries, the towering Andes should be classed as a favorable instead of a frowning feature in material, industrial and agricultural advancement. Down from their sides in some sections, though not in all, come rivers which have been harnessed or must be harnessed for irrigation, electrical power and other utilities. Though in the main the Andes present a front to the Pacific which is uninviting, they contain in the interior numberless valleys and numerous plateaus, which only await connection with the coast by railways to become the home of considerable populations and the scenes of industrial and agricultural prosperity.

The Eastern South American Republics.

Turning now from the northern and the western portion of Latin America, we consider the vast area, the economic and commercial conditions and the potentialities of the countries of South America tributary to the southeastern Atlantic; namely, Brazil, Uruguay, Paraguay, and Argentina. Here we have a population of approximately thirty millions, and a foreign commerce, in normal conditions, amounting annually to $1,500,000,000, and it is no exaggeration to predict that, when peace is again restored in Europe and these countries have recovered from the blighting influence of the war, this trade will commence a development which within a decade, or at the outside within twenty years, will double itself. Despite the fact that in one or two of these countries there was a financial depression prior to the war, they have such enormous natural resources and capacity of production that they must go forward even beyond present realization. The fact alone that Brazil has an area greater than that of the connected area of the United States, with every variety of climate and product, with navigable waterways more extensive than those enjoyed by any other nation, and with a coast line on the Atlantic nearly equal to that of the United States on the Atlantic and Pacific combined, is evidence in itself of her potentialities. Although it may be true that the 20,000 miles of navigable waters in the valley of the Amazon are largely in the tropical belt, the new life which is coming to the tropics as a result of the experiments already successfully demonstrated in Panama, along the Caribbean, in India, and in other tropical sections, proves beyond question that in reasonable time the Amazonian and tropical section of Brazil will become the scene of an economic evolution and the home of populations not dreamed of by the average observer. If, therefore, the investors, the capitalists, the engineers, and the advance agents of commerce of the United States realize now this possibility and get ready to co-operate with the Brazilians in this development, they cannot fail to bring great and good results eventually alike to the United States and Brazil.

Uruguay and Paraguay are small in area compared to Brazil and Argentina, but they make up for this in present progress and future potentialities. Uruguay occupies a position of importance on the South American map not unlike that of Holland and Belgium on the map of Europe. The foreign commerce it already conducts amounts to nearly $100,000,000 annually; and its progressive capital, Montevideo, which has recently spent $10,000,000 on harbor improvements, convinces any observer of Uruguay's importance and wealth. Paraguay has suffered in the past from comparative isolation, but the world is now realizing that it is a land of great agricultural possibilities.

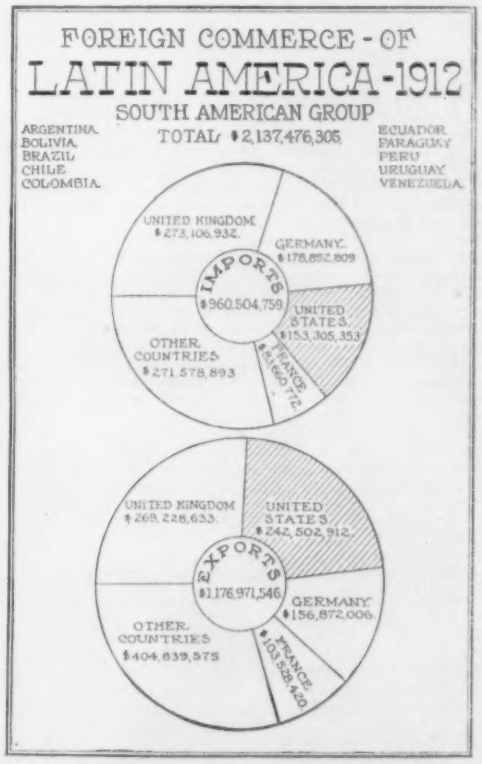
The Progressive Position of Argentina.

Reserving for the last, but not as least, consideration of the Argentine Republic, we discuss a country which is one of the most interesting and inviting in the wide world. Located almost entirely in the south temperate zone, having a greater reach in its connected area from north to south than the United States, covering more square miles than that section of the United States east of the Mississippi River, and conducting an annual foreign commerce valued in normal times at nearly $900,000,000, it certainly is deserving of the closest study. Although it has been characterized with the construction of a railroad system and an agricultural development more extraordinary than that of any other country in the Western Hemisphere, except the United States, it has only just begun to enter upon a period of power and position in the family of nations which must grow in influence and wealth as the years go by. While the central section tributary to the mouth of the River Plate system has reached an extraordinary prosperity, large sections of the northwest and southwest correspond in their possibilities to the similar sections of the United States and are worthy of the closest inspection by the constructive engineers, capitalists, commercial and financial interests of the United States. Buenos Aires, the capital of Argentina, is typical of the land as a whole. This city, with its population of 1,600,000, to-day ranks as the third city in the Western Hemisphere, coming after New York and Chicago; the second Latin city of the world, ranking after Paris, and the largest city south of the Equator! When I was minister there ten years ago, I frequently counted along its extensive system of docks and wharves a hundred merchant vessels loading and unloading! The Argentines themselves are a genial and progressive people, and recognize the value and usefulness of the cooperation of legitimate foreign interests.

In concluding this survey of a portion of the Western Hemisphere which extends from Mexico and Cuba south to Argentina and Chile and covers an area of nine millions of square miles, or three times that of the United States proper, which maintains a population of seventy-five millions that is increasing more rapidly by reproduction than the population of the United States, which in the future may prove even a greater field for immigration than has this country, and which already buys and sells in trade with the foreign world products valued at the immense total of nearly $3,000,000,000, we must remember that the most important factor of all in its relations with the United States is the practical application of reciprocity of interests. The great material interests of the United States must not only consider their own opportunity in these countries, but the opportunity for these countries in the United States! Our business men must endeavor to increase the market for South American products in the United States as well as the market in South America for the products of the United States.

A Final Word of Caution.

A word of caution, however, must here be emphasized. It is a mistake to assume that, on account of the war in Europe, there is to be an immediate and enormous



The trade of the South American republics.

profit in Latin America for the commercial, financial, industrial, and engineering interests of the United States. It will require considerable time for a readjustment of conditions that will permit of such possibilities.

Opinion from Prominent Business Men on Our Trade Opportunity

An Unprofitable Experiment

My company's experience in its line proved it unprofitable in the South American trade against the competition of European manufacturers, whose facilities in costs of production, shipment, and banking were such as to highly discourage our efforts.

SIDNEY MASON,
Philadelphia, Pa. *President Welsbach Company.*

High Standards are Necessary to Hold Markets

If a foothold is once secured (and it does seem under present conditions as if there should be no difficulty in getting such trade as would be satisfactory from the point of view of terms of settlement, etc.), the following two factors would be of great importance.

The manufacturers of the United States have finally discovered that, in order to hold *any* market, their product must be of the very highest standard and so maintained.

They have also learned to study the peculiar requirements of any market, and I believe will thus be able not only to supply the very highest grade of product, but one which, as a result of such study, will be best adapted for the country in which it is sold.

A. J. PORTER,
Niagara Falls, N. Y. *The Shredded Wheat Company.*

Give the South American What He Wants

Before the American manufacturer can hope to compete for the world's trade in foreign markets, he must study the conditions and the wants of the various countries and the peoples with whom he seeks to do business. No manufacturer who confines his business to America would continue to make last year's styles to sell to this year's trade, but some manufacturers seem to think that, because the style or character of an article suits the American trade, it is good enough for the foreigner. Until he is ready to treat the foreigner with the same consideration that he treats his home trade, especially when he attempts to compete with others who do show that consideration, he is going to be at a disadvantage.

In other words, no matter where you sell your goods, you must give the buyer what he wants and in the way in which he wants it. If you study the conditions abroad with the same care that you would study those at home, it will be found that there will be an ever-growing foreign market for the products of American manufacture.

J. W. EARLE,
New York. *President Remington Typewriter Company.*

Study Your Market

First, learn the people, their characteristics, their methods, and, being properly introduced and accredited, observe their conventionalities.

Second, give them the goods they want, as they want them, and in quality as represented.

Third, learn how to ship, ship as instructed and with particular regard to handling and moving on the part of the customer on reaching destination.

Fourth, and a prerequisite, good banking and exchange facilities.

Fifth, and a prerequisite, ships to carry the goods.

The fourth and fifth answers are really the most important, and can be obtained most readily by agitation on the part of important financial, commercial, and manufacturing associations.

The new Federal Reserve Act helps in the matter of banking facilities, and it looks as though recent events were going to facilitate the shipping.

A permanent customer is one who is properly used and who is pleased with his goods.

FRED'K S. FISH,
President The Studebaker Corporation
South Bend, Ind.

A Conservative Policy Advocated

In our industry, which is a specialized one, there are competing companies established in England, France, Germany, Austria, Russia and Japan, and owing to our disadvantage in high cost of labor, the fact that many of our raw materials are imported and that all our charges, including overhead costs, are so much larger than those of the foreign manufacturers, we are unable to compete with them as to costs, in their own or other countries. Even in the United States, under the present reduced tariff, these manufacturers are enabled to undersell us in many lines, particularly those in which labor plays an important part.

Under such circumstances, even though for a time the foreign output is curtailed, it would not be a prudent policy to invest large amounts of capital in increasing plants and establishing markets, with the certainty that after the lapse of a definite, and not very long period, the old conditions of comparative costs, etc., would be again restored.

Regarding the problem as it affects business generally, I do not profess to be well informed. No doubt each class of industry has its own problems to meet, but I think that those who are not, in some way, favored by local conditions, will be in the same position as ourselves.

M. C. LEFFERTS,
New York. *President The Celluloid Company*

Difficulties of Obtaining South American Trade

Outside of staples, which conform to world-wide standards, American products can only successfully be introduced into foreign markets by the manufacturer who studies those markets on the ground or through competent representatives, and who is willing to incur the trouble and expense involved in conforming his products to the needs, customs, and preferences of the markets he seeks to enter. If catalogues are required, they must be printed in the language of the country. In the case of minor products, at least, stocks should be carried at the large commercial centers, or else liberal terms of payment should be extended on factory orders. Where traveling salesmen are employed, it is indispensable that they should speak the language of the country. If customers are permitted to settle through some local and convenient channel and in local funds, business, especially with houses of the smaller class, will greatly be aided and encouraged.

HENRY R. TOWNE,
President The Yale & Towne Manufacturing Company.
New York.

First Hand Knowledge is Needed.

American export trade can be increased permanently in only one way, viz., by meeting European competition as to price and terms. We may increase export sales temporarily in many lines because of the shortage of European goods, but trade can only be retained by meeting competition.

Almost all South American and Eastern trade is done on long time. Credits are extended for a year or more. This is entirely contrary to the American way of doing business, and the average American business man will not consent to it providing he can sell his goods in his own country on short time.

In most lines of goods manufactured almost entirely by machinery, competition as to price is comparatively easy owing to improved and perfected methods of manufacture in American factories, but where human labor is the principal factor in manufacture, it is hard to compete in price with European goods because of the lower average wage scale in Europe.

In order to gain a permanent foothold in the export trade, there must be a very careful study of the tastes and demands of the people of South America and the East. This careful previous preparation is not characteristic of the average American business man. It will be necessary, however, if we wish to retain a large export trade.

CHARLES H. HULBURD,
Chicago, Ill. *President National Watch Company.*

Foreign Trade Must Be Systematically Sought

It would seem that the opportunity was ripe for the manufacturers in this country to secure quite a portion, at least, of the trade of the South American states that has heretofore gone to continental Europe.

But in order to accomplish this, it will be very necessary for the American manufacturers to "go after" the business in a systematic way and send their representatives to visit the merchants in those states, and such representatives should be able to speak the Spanish language and thus come in personal contact with those whose trade they are seeking.

There seems to be a feeling on the part of some of the manufacturers in this country that there will be in the near future a great influx of South American buyers in this market seeking the various classes of merchandise which are adapted for their use, and ready to take them as they are put up for our home market. This, I think, is a mistake, and while there may be a few such buyers, they will be comparatively limited outside, perhaps, of a few lines.

The American manufacturer, if he wishes to obtain and hold any of this trade, must meet the requirements made by the buyers and not try to force them to adopt the American methods, either in the makeup or packing of their goods.

The Merchants' Association has a fully equipped Bureau of Foreign Trade, and is prepared to furnish all the information possible to any of its members, or the public at large, who are seeking for a market for their goods in South America.

W. A. MARBLE,
President The Merchants' Association of New York.

The Essential Factors

The present war in Europe has furnished an opportunity in trade and commerce which, if grasped by our bankers and merchants, will mean more to us than it is now easy to realize. In order to take advantage of this opportunity and to secure permanently a foothold in foreign markets we must ascertain those factors which are essential to success.

1. We must have an exchange market.
2. A merchant marine.
3. Our merchants and manufacturers must have a knowledge of the needs of the different markets and be willing to meet them.

Sergius Sazonoff, the Russian Foreign Minister, has just made the following statement: "It is the country which foresees the situation commercially in Russia that will reap the enormous benefits that the Russian markets now offer. It is not enough that merchants and manufacturers should offer their goods here. Experts should be sent here now, even while the war is still in progress, to study and examine the wants of our country. Our duties, our manner of doing business, and our present and future wants and growing demands should be studied scientifically."

What Mr. Sazonoff says as to Russia is equally true of the other markets of the world. It may be interesting to know that the Merchants' Association of New York has an industrial bureau, which stands ready to assist the merchants and manufacturers, among its members, by supplying them with all the information that is available regarding foreign markets.

WM. FELLOWS MORGAN,
President Brooklyn Bridge Freezing and Cold Storage Co.
New York.

Cheap Goods Are a Necessity

We have tried out many markets in our line of goods and find that we cannot make the ware cheap enough for us to secure any considerable business.

Of course this does not apply to every other line, but we have spent a good deal of money endeavoring to exploit export business. We had a warehouse at one time and carried a large stock in London, but it was an unprofitable venture after a full trial, and we gave it up. We also had a showroom in Paris and have done some trade, but we finally abandoned that. We have been doing some business in Germany and Russia on special lines of goods, but on the ordinary staple run of goods it is impossible for us to compete with English and other foreign manufacturers in our line.

As to South America, we have an agent at the present time, not exclusively, however, but one who thoroughly understands our business, in the Argentine and Chili. We sell some of the more expensive lines of our goods there, but the ordinary run of ware, our staples, which constitutes probably 60 per cent of the business, cannot be sold there because of the fact that the English manufacturers can undersell us.

Furthermore, naturally we have not had the banking facilities or the shipping facilities there, which has put us at a still further disadvantage. Now that the banking facilities will in a short time be secured, we have no doubt that with some direct shipping facilities we might be able to do more in that country. We have word from our agent that things are a little too unsettled there to endeavor to press for anything at the present time, but that he is looking out for the conditions, and just as soon as there is a chance for improvement we will be informed

We have not neglected the opportunities of trying out certain places for export business, but we pay good wages to our men, far more than are paid in other countries, and the principal expense in our business is the wage scale, as we use little or no machinery.

As I stated in the beginning, you can use any portion of this letter you please, because I have not undertaken to generalize on the question, leaving that to others, but simply give you our experience in our efforts to secure a line of export business.

J. H. CAMPBELL,
President and General Manager The Trenton Potteries Co.
Trenton, N. J.

A Study of Foreign Banking and Business Methods Essential

I share the apparent view of the majority, that the time is most opportune for this endeavor. It is my humble opinion that our banks must have foreign branches and be in a position to extend credit to our foreign customers, since they are unaccustomed to paying bills promptly. Our manufacturers must learn the kind of articles desired and the manner in which they must be packed, to suit the requirements of foreign customers. It has been said, and I think with a degree of truth, that the willingness on the part of the Germans to do this, has enabled them to compete successfully with the English manufacturers, who prefer to retain their own standards. Our consuls should be capable of rendering the same valuable service as the English and Germans, and, of course, we must have a good marine service to the various countries with which we trade. Even should we be afforded the same banking and transportation facilities that England and Germany have heretofore enjoyed, we must, by manufacturing skill, coupled with large production, be able to offset the higher cost of labor in this country as compared with those countries, and what seems to me a great essential, is to prove by our acts that we maintain a standard of quality for our products. Unfortunately, we do not have this reputation at present, and while I hope it is not well founded, the impression still exists abroad.

R. L. PATTERSON,
President American Machine and Foundry Company.
New York.

A Trade Commission to Study Export Trade

There is no question in my mind that the present is a particularly appropriate time for the United States to secure a larger portion of South American, Russian and other export trade, the South American trade alone amounting to more than seven hundred and eighty millions. The war is only an incident which should act as a reminder of our negligence in the past. The four hundred odd millions which we have spent on the Panama Canal gives us tremendous advantage. Despite this and other natural advantages, we nevertheless cannot gain our object without great effort.

In this letter I do not care to discuss in detail the various elements that are needed to secure our portion of the world trade, such as transportation, financial arrangements, and the question of sending efficient salesmen to the spot to ascertain the demands of the country. I simply wish to point out in a general way my views as to how this business can be secured.

We have been held back from getting our share of the world trade, and we will be held back in the future even more because this export trade cannot be obtained by the middle or small class merchant who wants to export, as he cannot afford to take from his capital account the money necessary to obtain data as to how to get this business. The larger corporations can afford to make these expenditures. But these corporations are frequently deterred from developing these outside resources, as they fear adverse legislation that would probably arise when it is realized to how great an extent these corporations control business. It is quite true that our legislators have generally stated that it is not their intention to interfere with big business *per se*. Nevertheless it is big business that has in the past been attacked.

My suggestion, therefore, is that when the Trade Commission which is to have supervision of corporations is appointed, it should be allowed a reasonable sum each year so that it can maintain a special department for the purpose of investigating and making recommendations how best the export business to foreign countries can be secured. The Commission will have at its disposal all necessary information gathered by our Consuls who can keep the Commission informed where business can be had, and all details as to the various classes of merchandise wanted, prices, quantities, and other information of importance. The Commission could make recommendations to Congress, after careful study, as to what is necessary in the way of transportation. Congress, if it sees fit, can and probably would do the needful in that direction. It would be necessary to provide proper financial arrangements. The Commission could consult with the Federal Reserve Board, which would be able to make recommendations to the Commission, or to Congress direct, as to what is necessary, and in this way financial difficulties could be overcome. In fact, all details could be obtained and worked out through the agents of the United States and distributed at a central bureau, or through Chamber of Commerce to the merchants throughout the country.

The central idea of my suggestion is that the Trade Commission should do for business much the same as the Agricultural Department has been and is doing for the farmers of the country. It is evident, as conditions are at present, that the smaller merchant cannot develop the opportunity of enlarging our export trade which is now before us. Certainly the present generation would get no benefits therefrom. The Commission should be impressed with the importance of the fact that it is not to be a body appointed by Congress for the purpose of curtailing business, but, quite to the contrary, for the purpose of developing business and getting greater opportunities for all.

The great importance of this Commission will be seen at a glance, as it will probably interfere with real big business, which will result in a loss of business to the country; but if the export business is developed, as it can be done, in a very large way, this new business will many, many times make up the loss that may follow the curtailment of real big business which may be ordered by the Commission because they may regard same as a monopoly.

DANIEL GUGGENHEIM,
President of the American Smelting and Refining Company.
New York

The Opportunity and Its Cultivation

Consideration of the North American manufacturers' opportunity in South America brings up several logical questions.

1. Have we an opportunity?
2. If so, how great is this opportunity?
3. How is the opportunity to be cultivated?

(1) Very likely the first question is superfluous. Very likely the general proposition that we have an opportunity in the southern continent is obvious; such, at least, seems to be the prevailing idea at the present time. The Germans, the Dutch, and the British discovered an opportunity there years ago, which they have consistently and persistently been improving ever since, while we Americans have been so busy developing our home market that we have kept aloof; but the opportunity is still there, and it is no respecter of nations. The tremendous area of the Continent, in a single one of whose thirteen countries—and that not the largest—might be contained Germany, France, Great Britain, Italy, and Switzerland, with room for Germany and Great Britain over again; a continent populated less than half as densely as North America, makes it evident that an enormous consumption of manufactured articles must take place before South America's development will have progressed to any extent.

We have always known these things more or less vaguely, but the European war has forced them on our attention very definitely, and has made it possible to make a profit, instead of loss, while building a trade. Demand must be supplied. A certain amount of this fruit would fall into the laps of American manufacturers, in the shape of orders, even if we were indifferent to export trade. The longer the war lasts, the longer the fruit will continue to fall, even if we do not see fit to get busy and climb the tree. And some of this business would be permanent, for the Latin-American is loath to change his business relations, once they are established. But the broad-gage manufacturer should not be satisfied with such a happy-go-lucky influx of business. Otherwise he would do well to avoid any permanent plant extensions or other investments of capital to care for a trade which, after a few years at most, will again be keenly striven for by European interests.

(2) *How great is the opportunity?* I would answer, "As great as the American nation is willing to conceive it in our plans and preparations." The limitation will be at the sending, not at the receiving end. Failure to recognize this has, I think, caused many to overestimate their ability to go down and do great things in South America. Why this is so may be realized by contrasting our own lack of preparation with the sagacity that has been displayed in foreign trade-building by other nations. The Yankee considers himself a born trader, but foreign traders are made, not born. Germany has been making them during the past two generations, until she has developed a whole race of them. Encouraged in every way by the imperial government, these specialized traders have methodically been campaigning for South American business for nearly half a century. They have evolved an educational system, a shipping system and a banking system, and that is just what we must do if we are to invade South America commercially.

The young German just entering business has been taught to speak three languages; the young American often cannot speak his own, and his brusqueness grates against the punctilious politeness of the South. This is a problem for our schools.

The Germans have worked out their shipping methods to a nicety, because they have studied them so thoroughly. When goods are to be shipped to a certain destination, they know whether coolies, burros, or auto trucks are to transport them over the last lap of the journey, and the goods are packed accordingly. Are we willing to devote this painstaking, but profit-insuring, attention to detail?

The attitude of the Government must have an extremely important influence on our success in distributing through foreign ports. The Kaiser is a business man. His consular and diplomatic service has been made to subserve and advance German industries, and the subsidized merchant has been an important factor. Even governmental pressure has sometimes been brought to bear on small manufacturers, who, on account of their smallness, were unable to serve the trade efficiently and at the same time yield a fair return to their stockholders, causing them to combine and thus operate more economically.

I know of no American banks in South America. Inasmuch as custom has fastened a system of extremely long credits on the country, our banks must go with us to carry these credits.

(3) *How is the opportunity to be cultivated?* In a word, by planning; by preparation. Certainly not by going to the South American countries in the spirit of adventurous traders, dictating our own business methods, nor yet by using them, as in the past, as a dumping-ground for over-production. "Create and perpetuate" should be our slogan. Only in this way can we build South American business on such a solid foundation that, when the floods come and the winds of competition blow, it will not be moved.

F. S. Terry,
Manager National Lamp Works of the General Electric Co.
New York.

Why We Will Find It Hard to Enter South America

Frankness compels me to say that I doubt if the American manufacturer ever will secure more of a relative foothold in the trade of South America than he now possesses.

Why?

Because he neglected his opportunity through the years gone by and has not now either the patience or the philosophic temperament to diagnose the situation from a business and commercial standpoint and measure up to it.

Let us not deceive ourselves, but look at this situation in South America as it actually is: Germany, England, France, Belgium, and Italy have Europeanized South America when it comes to domestic and foreign trade and commerce. These countries not only supply South America with the products of their factories, but they have supplied that continent with the money that has developed its own resources. The United States has had no part in it.

The Monroe Doctrine may have been potential as against a European flag, but it has not hindered the European dollar from securing a permanent foothold in the southern half of this hemisphere.

European capital so completely dominates South America as to make Europe all but supreme in her business and commercial activities, save in the midst of such turmoil and confusion as now prevails across the sea. One has only to visit the countries of South America to be impressed with the fact that European capital improved their harbors and controls their docks and wharfs; that European capital developed their mines, built their railroads, constructed their public utilities, financed their national debts, supplied ocean ships, now gives stability to their banks, provides officers to give instruction in their armies and navies, and in every way imaginable has so completely worked itself into the warp and woof of business, social and governmental life as to all but justify the claim to vested right.

In short, the European dollar speaks the language of every country in South America.

How will we get in there permanently now? Certainly not by proceeding on the assumption that while these European countries are at war, we can sneak in, snatch up, run away with and permanently possess that which is related to untold millions in the way of investment, and represents generations of the most patient social and business cultivation. Foreign trade and commerce are not secured and made permanent in this way.

While South America will take what we hurry to her in this emergency, in our government-owned ships, purchased under the spell of commercial hysteria, we must not let the people down there get the impression that we are attempting to take advantage of our wounded and crippled European neighbors in their hours of awful anguish, and thus secretly form a contempt for us.

South America will certainly not forget that until this horrible cataclysm in Europe, there was not a single ship flying the American flag plying between the United States and that country, beyond the Carribean Sea.

Advising just how to permanently secure a foothold in those markets, I would urge the study and emulation of the methods pursued by European nations through many, many years.

I consider it more timely and important, however, to suggest *how, in my opinion, we cannot permanently secure such a foothold.*

We cannot do it by offending the South American's sense of what is manly, fair, and right. He is proud and chivalrous. He scorns to take advantage of a fallen foe either in war or trade, and I warn American business men to watch well their ways or they will learn that whatever temporary advantage they may appear to gain in this emergency, will be later thrown back upon them with scorn and derision.

Europe and South America are united, not only by commercial, but by social and family ties. Their people visit back and forth. Tens of thousands of them have homes in both continents. They speak each other's language; their families are intermarried. The mere suggestion that American manufacturers can throw business and commercial blandishments round South America that will cause those people to weaken in their loyalty and affection for their European relatives and friends while they are engaged in a life-and-death struggle is absurd.

I have spent considerable time in South America and I know how those people prize intimate acquaintance, how they value warm friendships, how they reverence those social and business traditions associated with the years that go back to long ago, and I know that when this cruel war is over they will fly to the arms of their old friends in a way that will cause "Uncle Sam," with his emergency-bought ships, to gasp in amazement.

So I would say that the way to permanently secure a foothold in the trade and commerce of South America would be to hold ourselves in absolute control through this trying ordeal abroad, curbing our enthusiasm and ambition for foreign trade, nor attempting to rifle the knapsacks of our fallen commercial competitors. Let us supply South America with whatever she needs in this crisis, doing it in a dignified, whole-hearted, generous way, sending her nothing that is not sterling. Then when Great Britain, Germany, France, and other European nations who have developed South America with their brains and money are themselves again, we can approach that field in a commercially sportsmanlike way, and on the theory that the Panama Canal has awakened our interest in business opportunities, trade advantages and undeveloped resources, down there, on the virtue and merits of our goods and the integrity of our methods and intentions solicit a fair share of their patronage and an equal opportunity in their undertakings.

And in the meantime, let us urge the American Congress to give such assistance to those having the courage and ambition to embark in the over-the-seas shipping, as will put vessels on the high seas flying the American flag, to assist in taking care of whatever business may be developed.

E. G. Buckner,
Vice-President E. I. du Pont de Nemours Powder Co.

The Adoption of European Methods and Co-operation of Our Government Requisites in Building Up Export Trade.

The first consideration is that the American producer, seeking a foreign market, must look upon such a proposition as necessarily involving the opening of a definite and permanent branch of his business, and as soon as he can ascertain what character of goods such foreign market requires, he must equip himself permanently to meet the demands of such market. No permanent foreign trade can ever be built upon the idea of merely utilizing such a market as an outlet for surplus products.

No better method can be adopted to secure and develop South American trade than has been successfully employed by such countries as Germany, Great Britain, and France. For example, Germany's method has been to send a specially fitted representative to South America, make purchases of products in actual use and demand, ascertain selling costs, and then to manufacture these products in the style, size and character demanded, and at a price which will enable successful competition with existing trade.

The second consideration in the development of a permanent foreign trade for this country rests upon the willingness of the Government to assist.

Every intelligent American, having any connection with shipping matters, knows that our maritime and navigation laws have lost to us annually, for the past sixty years, not only a very large foreign trade, but also hundreds of millions of dollars in transportation charges. These laws should certainly be either repealed in whole or modified beyond recognition and new laws should be adopted, based on the experience of other nations, whose object shall be the upbuilding and not the throttling of an American merchant marine.

The very crisis through which our trade is now passing shows that we should have a *home-made merchant marine.* This is necessary not only for the extension of foreign trade, but for the protection of the trade which we now have. At the present moment, America has approximately 14 per cent of the export trade of the world. Less than one hundred years ago American ships carried fully 90 per cent of our then foreign shipments. To-day only a small percentage of this trade is carried under the American flag. Of the entire export tonnage of the world, 58 per cent is carried under the flag of Great Britain, 14 per cent Germany, 8 per cent United States, and 5 per cent France.

The reason for America's lost foreign shipping and the failure to develop on any scale the shipbuilding industry, with all of its ramifications and possibilities for the investment of capital, employment of labor, purchase of supplies, etc., is due to the severe hardships placed upon vessels sailing under the American flag, and the failure of the Government to enact such laws as will enable the construction of American ships, the upbuilding of a great shipbuilding industry, and the operation of American ships on an economical basis.

It is claimed that it costs from 25 per cent to 40 per cent more to build and equip a ship in America than in any other country, and from 25 per cent to 30 per cent more to operate an American ship than the ship of almost any other nation. A vessel of 10,000 tons under the British flag can, therefore, be maintained as cheaply as a vessel of from 6,500 to 7,000 tons under the American flag. If some of these handicaps could be eliminated or overcome by Government aid, the vast increase of trade and commerce to result would certainly bring great prosperity to American labor as well as capital.

I, personally, do not believe in government-owned merchant ships. I should much prefer to see this Government make loans on American-built bottoms of certain tonnage, up to a certain per cent of the actual cost of construction, at a rate of interest sufficiently low, say 3 per cent, as would attract and inspire capital sufficient to develop a real home-made merchant marine. It is a fair assumption that, after a short period, this industry, once established, would be able to stand without Government aid. As a temporary measure solely and to meet the present emergency, the same principle of Government loan might be applied to foreign-built ships taking out American registry.

A third consideration in the establishment of permanent foreign trade is the development of necessary banking facilities for handling credits between foreign countries and the United States. At the present time, America buys probably 50 per cent of the coffee, rubber, hides, and wool produced in South America. Practically all of this business is settled by exchange on London or some European city. Here is a credit balance in favor of South America which, as soon as a sufficient trade is developed with South America by the sale of American goods, can be utilized against the debits thus created and settlements made through American banking institutions already opening branches in the principal South American cities.

Banking facilities and trade always follow the flag, and there is little doubt but that the American banker will produce all the banking facilities necessary to handle the South American trade, as soon as the American producer seriously enters the field and the American Government gives evidence of an intention to foster the development of such a trade.

A good example of the readiness of trade to expand upon the slightest encouragement is found in the apparent results of the reciprocity agreements made between Brazil and the United States in April, 1891. The exports of cotton piece goods, bleached and unbleached, wearing apparel, and other cotton manufacturers, which in 1899 were $684,584, in 1890, $813,700, increased in the three following succeeding years during which such reciprocal agreements were in force, to $1,146,960, 1892; $1,402,569, 1893; $1,538,689, 1894.

A further consideration in the development of foreign markets is found in the assistance which bankers can, and usually do, give in financing loans to foreign governments which furnish a trade outlet. When the Balkan war broke out, the more important countries in South America were seeking loans from European banks. Naturally, with the development of that war, these loans were impossible. Last July these countries were again seeking, and seemed in a fair way to obtain, similar loans of European capital. These loans will now probably be deferred for a long time. This is an opportunity for American bankers, if sufficient funds are at hand. European financiers have frequently loaned money to these governments with the stipulation that a large part of it be used in buying the products of their mills. American bankers entering this field can obtain similar concessions. If such loans could be made, a large part of the funds would come back to the United States in payment for our goods.

William C. Breed,
Member of Breed, Abbott & Morgan,
New York. *Attorneys and Counselors.*

An Efficiency Engineer's View of American Opportunities in the Present World Crisis

Those who have been many years in active life know that it takes about a generation—twenty-one to thirty-three years—to evolve, develop, and succeed in something new. Occasionally the time is shortened, as in the case of that glorified American manufacturing genius, Henry T. Ford, but in most cases the rule holds, as in the case of James J. Hill, Rockefeller, Carnegie, Guggenheim, Woolworth, Larkin, and others.

Therefore, to attempt to use the present crisis to develop wholly new lines of American business actively will cause disappointment. The time is not sufficient in which to make mistakes and retrieve them. For instance, the war may stop the manufacture and importation of Brussels lace. It would be highly foolish to attempt to transplant the industry to the United States. It is manifestly an industry that might take a hundred years to develop. We import about $8,000,000 of toys annually. We shall not get them this year. I would not recommend to any American to start the industry of making Noah's arks or tin soldiers.

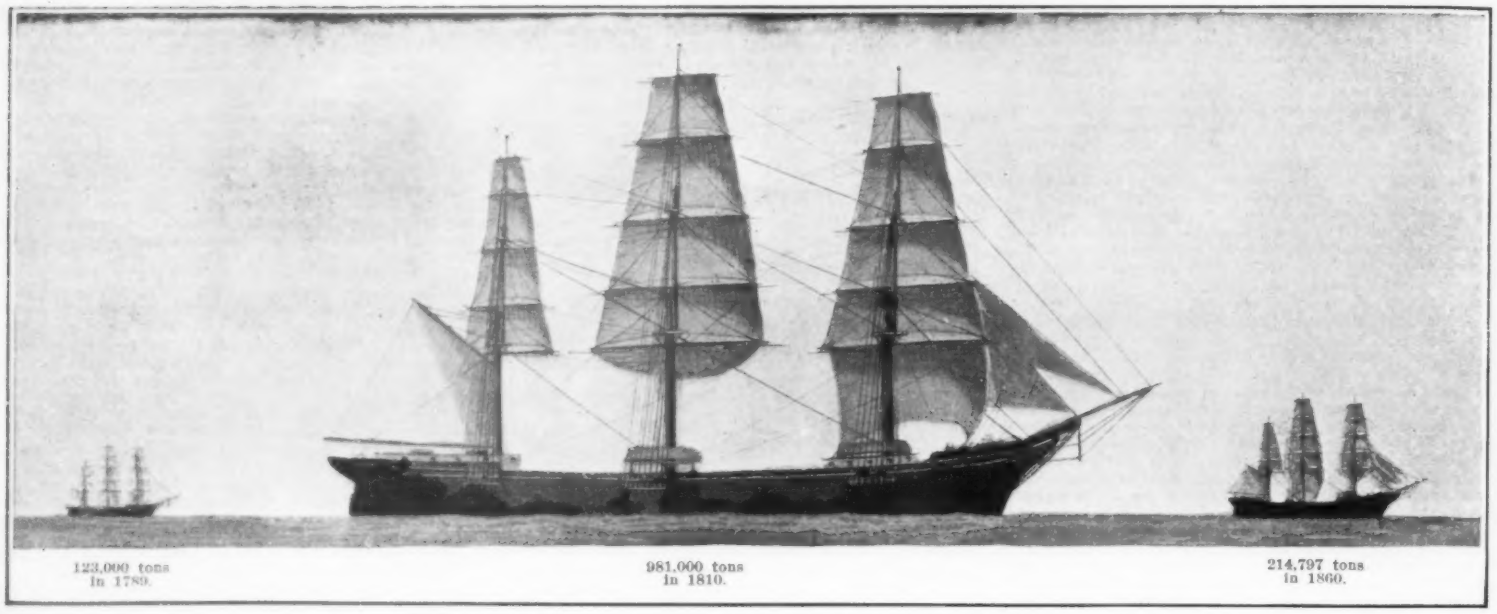
On the other hand, there is an excellent opportunity to push those competitive lines in which we already have a start.

Our export of coal, of lumber, of agricultural products, ought to be pushed. Our farmers are getting very little for their peaches this year. They were not prepared to can or to dry them. What a pity! Agricultural implements ought to be pushed and German trade be supplanted. Other existing manufactures ought to be pushed.

What we most need as to foreign trade is to supplement and develop existing agencies rather than to embark on a long-winded attempt to create new agencies. Why should we wait for an American merchant marine when there are hundreds of British, French, Scandinavian, Japanese, and Greek steamers available, all of which can operate under charter more cheaply than any vessel under American flag?

Let us play the games we have learned, not switch onto new ones.

Harrington Emerson,
New York.



The rise and decline of our oversea shipping between 1789 and 1860.

Our Merchant Marine; Past, Present and Future

I. The Past

By Winthrop L. Marvin, Author of "The American Merchant Marine. Its History and Romance"

FOR years before 1898 the American people had desired and sought an Isthmian Canal, but the Spanish war and the voyage of the "Oregon" made that canal a certainty. So the great European war of 1914 will make a certainty of an American merchant marine in overseas trade.

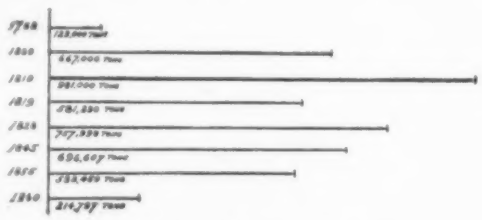
We had such a merchant shipping once. The story of how we secured it and of how we lost it may help to an understanding of how it may most surely be regained. The War of the Revolution showed the maritime genius of the American race. John Paul Jones's victorious Yankee tars were merchant sailors and fishermen, and the crews of our privateers afloat in 1777 almost equaled the strength of the Continental Army under Washington. Never had British commerce been so mercilessly harried, right in the chops of the Channel and the Irish Sea. Parliament in alarm ordered a special investigation of the Yankee private-armed cruisers, which captured or destroyed three times as many of the enemy's vessels as did the entire Continental navy.

But these incomparable ships and men could make no headway in competition with wealthier British merchantmen after the war had ended. The period from 1783 to 1789 was one of desperate poverty for the sea carriers of the new republic. In 1789, the first year under the Federal Constitution, only 123,000 tons of shipping were registered under our flag for ocean trade, and all but 23 per cent of our own imports and exports were conveyed by foreigners.

American Shipping in Washington's Time.

That was the condition of American shipping when George Washington became the first President of the United States. A single decade later, in 1800, fully 667,000 tons of shipping bore the Stars and Stripes to foreign ports, carrying 89 per cent of American commerce. Another decade passed, and in 1810 American vessels for overseas business registered 981,000 tons, conveying 91.5 per cent of our external trade. The mercantile history of the world affords no parallel to the swift expansion of the American merchant marine in the first twenty years of our national existence.

What had happened in 1789 was this: Congress, on the initiative of Washington, Madison, and Jefferson, had made the merchant marine a nationally protected industry—the most vigorously protected industry in America. This is no time and there is no space for an academic discussion of protection versus free trade; I am merely reciting a historical circumstance. In 1789 and for many years thereafter an American ship was permitted to land her imported cargo on the payment of a rate of duty 10 per cent less than that exacted



The rise and decline of American shipping.

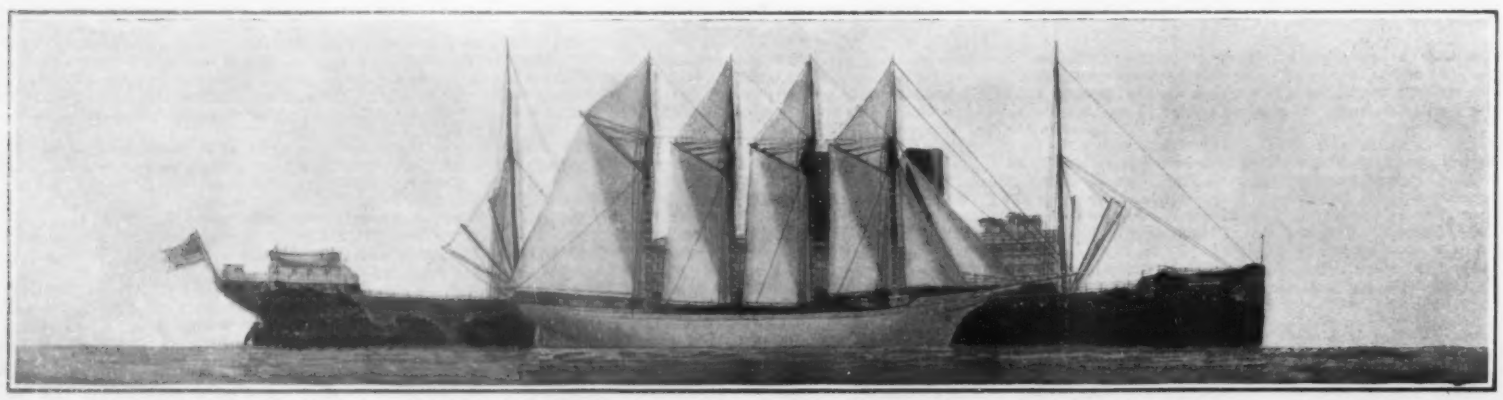
on a similar cargo brought in a foreign ship, and in those years there was almost no free list—almost every foreign article was dutiable. An American ship paid a tonnage tax of 6 cents a ton on every arrival; a foreign ship paid 50 cents. And as a special inducement to develop a direct East India trade, tea imported in an American ship straight from the Orient paid a duty of from 6 to 20 cents a pound according to variety, while tea imported in a foreign ship paid from 15 to 45 cents. This was prohibitive protection; it was intended to be such. No teas came to America except under the American flag, and Boston, Salem, and New York whitened the Indian Ocean with their adventurous sails.

A reaction came after the War of 1812. Astute British diplomacy outwitted our amateurs, and won a cessation of the protective customs and tonnage rates in the direct trade with the United Kingdom. But elsewhere Washington's policy was maintained unchanged, and American shipping, which had fallen to 581,230 tons in 1819, rose again in 1828 to 757,998 tons, carrying 88.9 per cent of our total commerce, or almost as much as in 1810. In 1827 the London *Times*, lamenting America's maritime growth, exclaimed, "Her starred flag is now conspicuous on every sea and will soon defy our thunder."

A Fatal Blow at Commerce.

In a mood of fateful overconfidence, Congress now passed the so-called reciprocity act of 1828 opening the carrying trade from other countries to the ships of Great Britain and our other European competitors. This was done by the South and the agricultural States against the protests of the merchants and the shipowners, and as Prof. Soley in his "Maritime Industries" well says, it wrought "a great and lasting injury." The proportion of American commerce conveyed in American ships "began almost immediately thereafter to fall, and it has been falling ever since, until it has reached almost the point of extinction." American shipping in 1845, though it had rallied somewhat from the low point of the first years of reciprocity, had not reached the maximum of 1810, and the share of the American flag in our own carrying had fallen to 81.7.

Now came the first steam lines of the North Atlantic and the Yankee clipper ships. Great Britain was first in the field with subsidies. She had cajoled us into abandoning most of the protection of preferential customs rates and tonnage taxes, though this was not wholly given up until 1849, and had herself adroitly launched upon the more direct and vigorous protectionism of liberal mail pay from the royal treasury. America was outmaneuvered and soon after vanquished, and this is a most important historical fact to remember at the present time. Under the preferential policy,



Comparison showing the growth of our coastwise shipping between 1860 and 1913. The sailing ship embodies in one hull the 2,644,867 tons of coastwise shipping we had in 1860, and the large steamer our coastwise shipping in 1913, amounting to 6,816,980 tons.

the merchant flag of the United States flew everywhere and prospered. It did not begin to yield and disappear until the policy of Washington was traded off by blundering diplomatists and then by a heedless Congress, whereupon Great Britain took up the potent expedient of subsidy, on which she has expended, to her immense advantage, $400,000,000 in seventy years.

Steamship Lines Subsidized.

For a time, on the initiative of a Southern Democratic President, Polk, the United States followed the British example, and subsidized new steamship services to Europe, the West Indies and South America. The triumphs of the American sail clippers were quickly repeated in the performances of American steamships, which held the record on every ocean. Our deep sea steam fleet increased swiftly from 20,870 tons in 1849 to 115,045 tons in 1855, almost equaling that of Great Britain, which had subsidized her lines much earlier. "The prospect, therefore, at one time," said David A. Wells, "was that the United States, although late in the start in this new department of foreign shipping, would soon equal, if not overtake, her great commercial competitor."

But, unfortunately, the sectional quarrel of North and South over slavery was now fierce in Congress. The Southern men, led by Jefferson Davis, saw a chance to strike a blow at Northern sea power and commercial power by canceling the mail subsidies which put American steamship lines on even terms with their British rivals. This was done—to the injury of the North, indeed, but to the heavy loss, as it soon proved, of the entire country. Though the American steamships as a rule were the better ships, exactly as the American clippers were, they were beaten off the routes—before the Civil War began. One of the great American merchants of that day was A. A. Low, father of Hon. Seth Low of New York. No man of his time better knew the shipping trade, and he has left his eloquent witness that "the English have deliberately and intentionally driven the Americans from the ocean by paying subsidies which they knew Congress would not pay. . . . They have driven us from the ocean by that policy as effectually as they ever drove an enemy from the ocean by their guns!"

All official facts sustain this impressive judgment. American shipbuilding, which reached its climax in 1855, under the impulse of the mail subsidies, the California gold discoveries and the Crimean War, decreased sharply from 583,450 tons in that year to 214,797 in 1860—"the swiftest and most alarming shrinkage in our national history." This was all under low tariffs for revenue only, before the first Morrill protective tariff, before the firing of the first Confederate guns on Sumter.

Civil War a Subordinate Factor.

The Civil War itself was only a late and subordinate factor in the decline of the American merchant marine. And that decline was not due to the economic change from sail to steam, from wood to iron. For American yards, under the mail subsidies, quickly built more and better steamships than English yards, with better boilers and engines—the despair of British observers at that time. And Boston, New York and Philadelphia were launching iron hulls before 1861—the handiwork of the same mechanics who soon after created in the monitors the most formidable armored navy in the world.

Much humbug has been written about the decline of the American merchant marine by men in this country and abroad who were anxious to serve the interests of the European steamship companies which now do nine tenths of the ocean carrying of the United States. It has been suggested, for example, that our nation could have saved itself in 1855-1860 by the purchase of "free ships" from British yards. But does any sane person believe that the mere purchase of a British steamship would make it possible to run that steamship profitably in competition with the Cunard Line, which was then receiving a subsidy of nearly $900,000 a year from the British government? To ask such a question is to answer it.

Since the Civil War every effort to extend national aid in any comprehensive way to our merchant fleet in overseas trade has been defeated by the stubborn sectional opposition of the West and South, which struck down the mail subsidies before the war and are directly and wholly responsible for the fact that there is almost no American shipping now to carry their grain and cotton to Europe.

The Stars and Stripes would have vanished from the seas, and American shipbuilding would have vanished with them, if it had not been for the steady maintenance of the century-old laws reserving the American coastwise trade, on river, lake and ocean, to the ships and sailors of the United States. It is this coastwise trade which made possible the launching of the "Oregon" and the "Olympia," before the war with Spain, and the dreadnoughts of the present American navy. American coastwise shipping has grown and prospered, from the 2,644,867 tons of 1860 to the 6,816,980 tons of 1913—a fleet nearly twice the foreign-going and coastwise merchant tonnage of the German Empire, and considerably greater than the whole shipping of France, Norway and Italy combined.

Europe's Fighting Motor Cars

By Theodore M. R. von Kéler

THERE is no doubt whatsoever that Germany's wonderful rush across Belgium and Northeastern France to within a short distance from the walls of Paris, was due to two things: a first-class mobilization plan and an equipment in motor vehicles second to none in the world. When the history of the present war comes to be written in later years, it will be found that the motor car, the motor truck, the tractor, motor-drawn cannon, and motor-driven aerial fleet have far exceeded the wildest hopes of their advocates.

Even from the meager reports available at this time, less than two months after the beginning of hostilities, the student of military tactics can judge the tremendously important rôle played by the motor vehicle in the rapid advance of the Germans, the collection and transportation of the British expeditionary forces and the swift concentration of the recruits and reservists at the army corps centers. What the auxiliary fleet of commandeered pleasure cars has accomplished along other lines is too complex a picture to be painted in a few words.

In a consideration of the assistance rendered by motor vehicles to the respective European governments in this titantic struggle, one must naturally take as a basis the number of these cars available. Exact figures are of course out of the question, for many factories on the Continent, particularly in Germany, have for months past been practically under the orders of the government and have manufactured and assembled trucks for military use, of which no hint appears in the official statistics, or in the subvention contracts of France, Germany, Austria, and Italy. But by means of a careful estimate of the number available in the early spring of this year, and the capacity of the larger companies specializing in this sort of work, it is possible to obtain a fairly accurate total.

Germany's Automobile Strength.

In Germany, military motor trucks, complete with trailers, to the number of 1,150 were under subsidy on April 1st this year. In addition the Empire had 14,700 commercial cars, capable of being converted into military vehicles. The order of mobilization placed at the disposal of the German General Staff approximately 15,000 delivery cars, not counting the trailers. In addition, the German army comprised at the beginning of this year the following "special" vehicles: 50 completely equipped motor kitchens, 100 motor ambulances, 500 motor-driven cannon, and 4 powerful tractors, which have been especially useful in drawing the new 42 centimeter siege guns of the artillery. About 200 armored cars, fitted with Maxim guns; 15 searchlight cars and a number of aeroplane repair wagons make up the remainder.

The government has commandeered the majority of all the pleasure cars in the Empire, amounting to probably 60,000 vehicles, for use by officers at the front, and for rapid communication in the rear of the army. Whole regiments are reported to have been shifted under cover of night by means of big fleets of motor cars to points 60 and 100 miles distant. In addition, there are with the army more than ten thousand cyclists and motorcyclists.

The shortage of gasoline, which has been the subject of much comment in the American daily press during the past week, is of little importance, as all the military vehicles can be run with equal facility on benzol and denatured alcohol, both of which fuels are available in considerable quantity in Germany.

France and the Motor Car.

Although more time and money have been spent by the French government in developing a satisfactory fleet of motor trucks, the total number of these is smaller than in Germany. At the last French army trials 110 separate units took part. The total number of subsidized army trucks is placed at 1,200, and the number of available motor trucks of all sizes at about 10,000. There are also large numbers of motor-drawn cannon, aeroplane guns, ambulances, and special cars, of a type similar to those used in the German army. France boasts of 95,000 pleasure cars, and some 20,000 buses, cyclecars, taxicabs, etc.

Great Britain's Automobile Strength.

With 18,000 motor lorries (as they are called) 228,000 pleasure cars of the large and medium type, 30,000 cyclecars and 185,000 motorcycles the United Kingdom should really be at the head of the list. However, Great Britain's big fleet of motor vehicles is a conglomerate of everything, without a standard. The British army trials succeeded in rounding up three manufacturers of trucks, who entered one vehicle each. Little attention and interest is manifest in Great Britain in army maneuvers in times of peace. Reports from France have it that about 2,000 motor trucks have been sent from England to accompany the expeditionary force, and these trucks are proving a source of much trouble to the army heads. Poorly supplied with spare parts, there is a great deal of waste and loss of time every time a part breaks under the severe strains of active war. The metric system in use in both France and Germany and the strict demand for interchangeability of the various parts on trucks of similar carrying capacity, makes it possible for the Germans or French to "borrow" necessary replacement parts from disabled or captured vehicles of the enemy. The British truck is dependent on its home supply, and cannot even utilize the French repair equipments. The number of special vehicles adapted for military use in the British army is comparatively small, not a single armored car being in its possession at the beginning of the war.

Eye witnesses of the German advance into France from Belgium say the first sign of the army consisted of six to twelve aeroplanes flying at different heights covering a width of ten and more miles. Slightly behind these aeroplanes came a fleet of twenty and more armored motor cars, capable of making easily 40 miles an hour. Against such a reconnoitering force the British cavalry was at a great disadvantage, as the quick-firing guns on the cars easily disposed of small bodies of troops, and the aeroplanes aloft gave notice in time of the advance of re-enforcements. Except in the thick of a battle no report has come from the battlefields showing that the advance army ever ran into an ambush. With armored cars scouring the ground below and aeroplanes peeking into things in general from above it would have been impossible for large bodies of troops to hide. In the beginning of this month strong pressure was brought by Gen. French, it is reported by British motor men, and some hundred touring cars were fitted with steel shields in such a manner as to make a presentable armored car squadron. Simultaneously the rapid advance of the Germans in the North stopped, chiefly, it is stated, because of the increased mobility of the English forces and the better protection given to the outposts by the armored cars, which engaged the German cars in pitched battles instead of fleeing before them, as the horsemen had been compelled to do before.

Where Russia Stands.

There are but 500 serviceable motor trucks in the Czar's domain, and nearly all of these are German and French. Several large orders have been received by American truck manufacturers, and nearly 1,000 of these vehicles are to join the Russian armies this year. If shipments can be made, they are likely to prove an important factor in the struggle.

The Other European Powers.

Austria has about 1,000 motor trucks and some 14,000 pleasure cars; *Hungary* less than 400 trucks and 7,000 pleasure cars; *Italy* can furnish a total of 12,500 pleasure cars and about 500 trucks of both small and large sizes; *Bulgaria* has less than 3,000 cars; *Servia* probably the smallest number of all the powers involved, namely 125 motor cars; *Turkey* has about 700 pleasure cars and about fifty military motor vehicles of special types made in Germany; *Roumania* counts 1,700 pleasure cars. *Greece*, early this summer placed an order for 400 motor trucks with an American firm, and is said to have received them just before war started; in this case it boasts of the total of 550 effective motor vehicles, not counting touring cars.

These are the motor fleets of the nations at war or likely to be at war. It is too early as yet to form a final opinion as to their value in a long drawn out war and their resistance to the elements under adverse conditions. But they have proven themselves an invaluable aid to an attacking force, bent on pressing forward with great speed into a hostile country. The next few months will show their full value to the modern army.

The German Fleet in the Baltic

ALTHOUGH the fleet of dreadnoughts and battle-cruisers of Germany, numbering sixteen ships in all, and its second line of twenty-three dreadnoughts has not ventured out to engage the British fleet in the North Sea, there is little doubt that it has been actively employed in attacking the Russian Baltic fleet and the various Russian seacoast cities and naval bases; also there have been engagements between sections of the Russian and German fleets. The accounts which have come to hand of these operations are limited and give only an incomplete idea of what has taken place. Our double page engraving in this issue represents a fleet of German dreadnoughts steaming in battle formation of line ahead, with one of the large naval Zeppelins maneuvering above it.

Notes for Inventors

A Device that Automatically Places and Removes Talking - Machine Records.—Graham J. Brogan, of Mt. Vernon, N. Y., has secured patent, No. 1,099,913, for a talking machine in which the sound records or disks are supported one upon another in a series, and are automatically applied one after the other to the pin of the machine.

Bottle Cap Remover.—In a patent, No. 1,100,818, to a Grand Rapids, Mich., man, is shown a bottle cap generally of the crown seal variety whose body portion is constructed in such manner as to facilitate the removal of the cap without a separate tool.

Improving the Dictation Graphophone.—Thomas H. Macdonald, of Bridgeport, Conn., assignor to American Graphophone Company of same place, has patented, No. 1,100,024, a dictation graphophone which provides, in a single construction, a "speaker" that is adjustable in any one of three positions (1) where it becomes a light reporter, (2) where it becomes a heavy reproducer, and (3) where it is neutral.

A Number of Edison Patents.—Thomas A. Edison has secured patents No. 1,099,241, for a rectifier, No. 1,099,346 for an improved mounting of the stylus of a phonograph reproducer, and No. 1,099,347 for a similar invention; No. 1,099,348 involving improvements in the stylus lever and floating weight associated therewith, and No. 1,099,349 for a method of making sound record molds.

Bombay Road Mirrors.—It is reported that the municipality of Bombay contemplates using road mirrors at dangerous points in streets or roads. This idea in itself is not new, having, it is said, been utilized with success in a number of English towns, and it is probable any considerable demand would cause some activity in this line of invention.

Players Combined with Moving Pictures.—A patent, No. 1,102,595, has issued to Herbert Knight, of New York city, in which what the inventor terms a composite dramatic production is carried out partly by living characters and real objects and accessories, and partly by moving pictures.

An Adjustable Bifocal Eye-Glass.—Benjamin N. Hanna, of Pittsburgh, Pa., has patented, No. 1,102,909, a bifocal eye-glass whose nose-piece is so constructed that the glasses when in position on the nose of the wearer may be thrown to alternate positions so that in the line or level of vision the wearer may use alternately the distance lens or the reading lens of the bifocal.

A Milk-Skimming Device.—A method which is said to be very good for removing all the cream from milk contained in a bottle or like vessel is to use a large round disk of rubber which takes a slightly concave shape, it being hung upon three light aluminium rods or wires. Slipping the disk in edgewise and below the surface, it then takes the flat position and can be drawn out with all the cream.

Making Tea While Traveling.—Tea or other infusions can be very readily made, for instance when traveling, by the use of a newly-invented device of a very simple kind. It consists of a cap made of wire gauze which has the exact shape of the teaspoon and fits upon it by a suitable clamp. Putting in the tea, etc., the cover is placed on, and the spoon is put in a cup or vessel of boiling water in order to make the infusion. This avoids carrying a teapot, and will often be found serviceable.

An Automatic Smudge Pot.—Frederick J. Fisher of Oakland, Cal., has patented No. 1,095,496, a smudge pot, in which a self-operated device ignites the fuel in the pot when the temperature falls to a certain predetermined degree.

A Picture Design Patent.—Design patent No. 45,429 has issued to Denison Manufacturing Company of Boston as assignee of Clara M. Nead of Rahway, N. J., for a paper sheet or similar article including a design in the form of a picture landscape which is specifically described in the patent.

Improvements in Comb Manufacture.—Patents Nos. 1,092,881 to 1,092,884, inclusive, have been issued to the Arlington Company of New York city as assignee of Frederick Wieland, for improvements in the manufacture of combs from plastic material, seeking to facilitate the removal of the surplus stock after the operation of forming the comb and to provide novel forms of dies for securing these results.

An Insulated Key.—John L. Ryan of Bayonne, N. J., has secured patent No. 1,094,478 for a key with an insulated handle portion especially designed to prevent injury from short circuiting when the key is used in connection with call boxes, fire alarm boxes and other electrical equipment.

Automatically Recording the Ship's Course.—Patent No. 1,094,487 has been secured by Francesco Spalazzi of Rome, Italy, for apparatus which during the movement of a ship automatically records the course of same upon a drawing sheet or even directly upon a sea chart when a suitable drawing scale has been provided.

A Divided Bed.—In patent No. 1,094,679 Frederick W. Roberti of Los Angeles, Cal., provides a partition for dividing a bed into two sections separate from each other and secures the bed clothing in such manner as to form two separate compartments in the same bed, producing, he claims, practically the same advantage as twin beds.

Centrifugal Pump Structure.—Patent No. 1,094,836 has issued to Henry R. Worthington, a corporation in New Jersey, as assignee of Carl George de Laval of East Orange, N. J., for a centrifugal, turbine and similar pump in which the special object is to avoid the whirling action of the water or other liquid entering the impellers and direct this suction flow so that the impellers will take up the water without substantial change of direction.

Activity in Novel Forms of Poison Bottles.—Some threatened legislation relating to special shaped bottles for containing poison has led to considerable activity in the production of novel designs for poison-containing bottles with a special view to securing a shape which will indicate at once, when grasped, the dangerous contents of the container.

Arc Welding Apparatus.—In patent No. 1,095,300 Theodore Varney of Pittsburgh, Pa., assignor to Westinghouse Electric Manufacturing Company, provides a simple control system by which automatically to govern the current in the welding circuit of arc welding outfits, so that the welding circuit may be maintained substantially constant and the operation improved.

Photographical Records of Liquid Dispensed from a Bottle.—Patent No. 1,095,313 to Charles H. Davids of Brooklyn, N. Y., seeks to prevent the refilling of bottles by photographically recording, as it is withdrawn, the removal of the original contents of the bottle by means of a photographic label applied to the bottle.

A Punch Machine with a Safety Device.—Patent No. 1,095,497 has issued to Otis Elevator Company as assignee of Ernest L. Gale, Sr., of Yonkers, N. Y., in which a safety device is provided so that the operation of the punch press is prevented when the pick-off device for removing the punchings and scrap is in an interfering position.

How to Nest Pyramidal Cartons.—James N. Pitkin of Los Angeles, Cal., has secured patent No. 1,095,671 for a package in which six pyramidal cartons are joined in series by separable connections so they can be easily assembled to form a complete cubical package.

Protecting a Battleship from Booms.—In a patent, No. 1,101,580, Joseph A. Steinmetz, of Philadelphia, provides a shield extending over the ship throughout and suitably supported by stacks and booms, the shield being adapted to be folded when desired.

Seeking a Substitute for Cork.—William Sanger, of Orange, N. J., has patented, No. 1,101,965, a method of treating wood to produce a substitute for cork, in which he seeks to remove all acid from the wood and then impregnate the wood with a solution of glycerine and water, after which it is dried for use.

Mobile Siege Guns in the Present War

(*Concluded from page 267.*)

the highest class of military roads, roads which as far as possible shall be free from heavy grades. Therein, no doubt, is to be found one predisposing cause which led the Germans to cling so tenaciously to their plan of campaign through Belgian territory. The magnificent highways through Belgium and northern France, stretching, as they do, through comparatively level country, are ideal for the transportation of batteries of these heavy siege guns rapidly to the fortifications of the French capital. At the outset of the war, the world wondered how the Germans could expect, as they evidently did, to be within the city of Paris in a few weeks time. The answer is to be found in their belief in the invincibility of the huge armies which they were prepared to pour through Belgium, and in the ability of this 11-inch mortar to cut a wide swath through the engirdling fortifications of Paris. The Germans, in our belief, never contemplated for a moment, a complete investment of Paris such as they made in 1870 to 1871. These 11-inch mortars have made such an investment unnecessary. Had the French-British resistance to the enveloping tactics of the German right been less successful, it is probable that the German army would have been in Paris at the present time.

We direct attention to our illustrations of a Krupp 11-inch mortar, installed on a permanent concrete base and protected with a shield of 2½-inch armor. Except for the overhead shield, the emplacement is similar to that employed by the Japanese in the reduction of Port Arthur. It necessitates the construction of a massive circular concrete base in which are embedded holding-down bolts. Upon this is placed and firmly bolted down the lower ring, or race, of a turntable upon which, by means of a rack and pinion, the gun is traversed.

As representing light siege artillery, we present two illustrations of an 8.26-inch mortar upon a mobile mounting. This gun is fired, like the howitzer, from its traveling carriage, and it does not require the preparation of any special platform. The whole equipment weighs about five tons when it is in action. It is provided with a constant recoil. Another illustration shows a 4.7-inch quick-firing field howitzer, with a controlled recoil, manufactured by the celebrated Ehrhardt firm.

A development in European field artillery which is of great assistance in promoting rapidity of fire is shown in our illustration of a 7.5-centimeter quick-firing field gun manufactured by Krupp for the Danish army. When this piece is limbered up for transportation, the gun caisson is so arranged that the quick-firing ammunition is carried with the nose of the projectile down and the cartridges in a vertical position. When the gun is unlimbered and run into battery, the caisson is wheeled around and tipped up so that the ammunition is in the horizontal position. The heavy steel doors are then opened on each side, and above and below, as shown in the illustration, and by this arrangement not only is considerable protection afforded to the gun detachment, but a minimum of time is consumed in passing the ammunition from the caisson to the breech of the gun.

The Turret Fort

(*Concluded from page 268.*)

of a 12-inch turret with one half open, so that the arrangement and cross-section of the turret and its plates could be seen from the outside. It was then intended to put up such turrets in the coast defences of America. But other ideas have prevailed later on.

The citadels of the Antwerp forts have 6-inch turrets, while smaller calibers for the defence of the moats, etc., are placed and protected in other iron and steel constructions.

Our illustration shows a turret and all its essential parts, the front wall taken away: the rotating cupola, in section, the disposition of the steel dowels between the chilled iron sectors of the cupola, and the location of the top plates. It further shows the two guns in the embrasures, and their carriages, the gunner at the sighting apparatus, the riveted substructure on its rollers and circular rail; the cross section of the protective outer cast iron ring, the stone and cement glacis, extending from this ring to the surrounding plateau and concealing the interior, the masonry and galleries, so that only the cupola and guns remain visible.

The two smaller illustrations are reproductions of the first photos, the SCIENTIFIC AMERICAN has received, showing the frightful effect of the fire of the big modern German howitzers on the fortifications of Liège. The iron and steel forts were completely demolished after a few rounds.

Attack and Defense by Submarine Mines

(*Concluded from page 271.*)

extensive use in the present European war. The views have been redrawn from sketches which appeared in our esteemed contemporary *The Sphere*. The mine itself, containing the explosive charge, is a hollow steel sphere filled with explosive and provided with a detonating charge and a trigger which serves on being struck by a ship to explode the mine. From the bottom of the spherical mine a length of cable passes to an anchor chamber, where it is wound upon a windlass; and, extending below the anchor chamber, is a plummet weight which assists in bringing the spherical mine to rest at the required depth. Before the mine is dropped from the mine ship, the plummet line is unwound until the plummet hangs at a depth below the anchor chamber equal to the depth at which the spherical line is to float below the surface of the sea. The anchor chamber and its plummet begin to sink at once; but the spherical case, being buoyant, remains at the surface. During the sinking, the cable between the spherical mine and the anchor box is unwound until a depth is reached at which the plummet rests on the bottom, when, the strain on the plummet line being taken off, a pawl to which it is attached engages the windlass and prevents any further unwinding of the cable from the anchor box to the spherical mine. The anchor box being heavier than the buoyancy of the spherical mine, continues to sink until it rests on the bottom, with the mine above it floating at the predetermined depth of from ten to fifteen feet below the surface of the water.

When a ship strikes the spherical mine, the latter is rotated and the contact lever is brought into touch with the hull of the ship, and by its action detonates the mine. In order to reduce the chances of a ship's passing unscathed through a mine field, the mines are sometimes laid in pairs, each pair being connected by a length of cable supported by floats, as shown in our illustration. In this case, when the bow of a ship engages the connecting cable, the two mines are drawn inwardly against the side of the ship, the effect, or course, being doubly destructive.

The only possible defenses against mines are countermining and sweeping. In the former case an attempt is made to set off the mines by detonating high explosives among them. The more effective method is to remove the mines altogether by "sweeping" operations, which are carried out as follows: Two vessels of light draft, such, for instance, as torpedo-boat destroyers or tugs, or (as in the case of sweeping operations carried out by the English in the North Sea) steam trawlers, proceed through the mine field abreast of each other, say, from 100 to 200 yards apart, and drag over the bottom of the mine field a length of heavy chain, which is connected at its ends to the two mine-sweeping vessels. The chain as it is dragged over the bottom engages such mines as lie in its path, which are destroyed by contact with each other or by a few well-directed shots from the vessels of the mine-sweeping fleet.

Operations of this character can be carried out only in the open sea or in waters that are not protected by the fire of shore

Running 100 miles on Low Gear,

these 116 Franklin Sixes make nation-wide demonstration of air cooling

Each of these Franklin dealers on September 24th ran his Franklin Six-Thirty car 100 miles *all the way on low gear without once stopping the engine*

This unparalleled feat was performed in 116 different localities under all sorts of road and weather conditions. The object — which was brilliantly accomplished — was to demonstrate the absolute superiority of direct air-cooling.

Certified Records

Name of City.	Dealer's Name.	Gallons of Oil Used.	Temperature.	Weather and Road Conditions.
Abilene, Tex.	C. B. Manly	.6	60°	Fair
Akron Ohio	A. Auble, Jr.	.4	64°	Mud
Albany, N. Y.	C. G. Heck	.9	62°	Clear
Amboy, Ill.	Andrew Aschenbrenner	.8	65°	Clear
Atlanta, Ga.	W. M. Hull	.7	61°	Heavy
Auburn, N. Y.	Geo. H. Leonard	.8	58°	Muddy
Baltimore, Md.	W. F. Kneip	1.8	82°	Bad
Bar Harbor, Me.	Fred L. Savage	.5	80°	Rough
Billings, Mont.	Arthur Barth.	1.2	80°	Fair
Binghamton, N. Y.	S. H. Lewis	.8		Muddy
Boston, Mass.	O. A. Lawton	1.6	87°	Clear
Bridgeport, Conn.	Arthur L. Clark	1.2	84°	Clear
Buffalo, N. Y.	Geo. Ostendorf	2	56°	Rain
Calgary, Alberta	A. F. Williams	.3	80°	Clear
Canton, Ohio	Geo. W. Belden	.7	65°	Fair
Carbondale, Pa.	S. F. Carpenter	1.2	62°	Rough
Carthage, Mo.	A. L. Caulkins	1.5	75°	Clear
Carthage, N. Y.	C. W. Shaffer	1.6	66°	Heavy
Cherokee, Ia.	W. R. Johnson	.9	56°	Fair
Chicago, Ill.	F. H. Sanders	1	58°	Clear
Cincinnati, Ohio	Newman Samuel	1.2	67°	Fair
Cleveland, Ohio	R. H. Eckenroth	.9	68°	Clear
Colorado Spgs., Col.	G. W. Blake	.9	65°	Hilly
Columbia, S. C.	Wm. Gibbes	1.3	80°	Showers
Columbus, Ohio	O. C. Belt	.8	54°	Rain
Concord, N. H.	W. H. Darrah		92°	Clear
Cortland, N. Y.	J. A. Farrell	1.3	57°	Mud
Cumberland, Md.	A. E. Glisan	1.3	67°	Rain
Dallas, Tex.	W. G. Langley	1.2		Clear
Dayton, Ohio	F. B. Heathman	.7	64°	Fair
Denver, Col.	F. C. Cullen	1	63°	Clear
Detroit, Mich.	W. J. Doughty	2.5	55°	Rain
Duluth, Minn.	J. D. Peacha, Jr.	1	44°	Bad
Eau Claire, Wis.	G. R. Wood	1.3	62°	Windy
Elizabeth, N. J.	F. V. Price, Jr.	1.5	86°	Hot
Erie, Pa.	John Griffith	1.2	80°	Muddy
Fall River, Mass.	Ernest Place	.9	88°	Hot
Forsyth, Mont.	Jack Lindberg	1	75°	Fair
Fort Dodge, Ia.	J. W. Crouse	.8	52°	Clear
Fort Plain, N. Y.	A. A. Walrath	2	58°	Fair
Galesburg, Ill., Car 1	E. T. Byram	1.3	70°	Clear
Galesburg, Ill., Car 2	E. T. Byram	1.3	70°	Clear
Geneva, N. Y.	W. W. McCarroll	1.2	58°	Rain
Georgetown, Tex.	T. J. Caswell	1.2	73°	Fair
Grand Forks, N. D.	I. W. Lyons	1	54°	Clear
Great Falls, Mont.	B. D. Whitten	1.1	76°	Clear
Greensburg, Pa.	E. L. Turner	2	65°	Bad
Greenville, S. C.	R. N. Tannahill	1.9	76°	Showers
Hampton, Va.	J. V. Bickford	2.5	82°	Fair
Hartford, Conn.	H. P. Seymour	1.2	80°	Clear
Hoosic, N. Y.	John Moseley		60°	Clear
Houston, Tex.	R. B. White	1.5	75°	Muddy
Ishpeming, Mich.	E. R. Nelson	1	56°	Heavy
Kankakee, Ill.	F. A. Babel	6	74°	Fair
Kansas City, Mo.	E. F. Williams	2	71°	Fair
Kingston, N. Y.	W. M. Davis	1.6	70°	Cloudy
La Crosse, Wis.	Alfred James	.7	66°	Fair
Laramie, Wyo.	E. Lovejoy	.7	78°	Clear
Lexington, Ky.	V. K. Dodge	.7	78°	Hilly
Lincoln, Neb.	Frederick Ryan		70°	Fair
Los Angeles, Cal.	R. C. Hamlin	1.5	62°	Clear

Certified Records

Name of City.	Dealer's Name.	Gallons of Oil Used.	Temperature.	Weather and Road Conditions.
London, Ont.	F. G. Mitchell	1	68°	Muddy
Louisville, Ky.	G. M. Younger	1	67°	Clear
Milwaukee, Wis.	Wm. F. Sanger	.9	54°	Dry
Minneapolis, Minn.	L. A. McKay	.6	58°	Sand, hilly
Moline, Ill.	D. H. Duncan	2	67°	Clear
Montreal, P. Q.	H. Grothe	1	59°	Muddy
Nashville, Tenn.	John W. Chester	1.2	67°	Fair
Newark, N. J.	W. L. Mallon	.9	81°	Clear
New Bedford, Mass.	S. C. Lowe	1.2	75°	Dry
Newburg, N. Y.	Geo. Mason	.9	74°	Clear
New Haven, Conn.	Cowles Tolman	1.2	80°	Sand, hilly
New York City	G. A. Tisdale	.8	81°	Dry
Norwich, N. Y.	A. M. Jones	3	58°	Bad
Oil City, Pa.	H. S. Phinny	.9	58°	Mud
Oklahoma City, Okla.	J. W. Lee	.4	74°	Clear
Pawnee, Neb.	O. H. Schenck	1	72°	Clear
Pendleton, Ore.	J. H. McCormmach	.6	56°	Clear
Peoria, Ill.	S. K. Hatfield	1.2	75°	Clear
Philadelphia, Pa.	Jas. Sweeten, Jr.	1	82°	Roads bad
Phoenix, Ariz.	Geo. Hageman	1	78°	Clear
Pittsfield, Mass.	H. G. West	1.3	69°	Cloudy
Pittsburgh, Pa.	W. Murray Carr			Rains
Portland, Me.	W. M. Chellis	1	80°	Hilly
Portland, Ore.	J. C. Braly	1.2	74°	Fair
Providence, R. I.	W. L. Wilcox	1.3	80°	Clear
Putnam, Conn.	O. C. Bosworth		86°	Fair
Redlands, Cal.	B. H. Hatfield		92°	Fair
Rochester, N. Y.	G. R. MacCollum	1.2	80°	Rain
Rockford, Ill.	L. J. Thiess	1.1	68°	Hills
St. Louis, Mo.	J. R. Dryer	1.1	72°	Hills
St. Paul, Minn.	A. H. Clark	1.5	48°	Fair
San Angelo, Tex.	M. C. Ragsdale	.8	62°	Fair
San Antonio, Tex.	L. F. Birdsong	1.2	86°	Fair
San Diego, Cal.	Wilson S. Smith	1.6	76°	Fair
San Francisco, Cal.	John F. McLain	1.6	70°	Bad
Saranac Lake, N. Y.	E. E. Bellows	1.2	60°	Rain, hilly
Scranton, Pa.	O. D. DeWitt	1.4	61°	Rough
Seattle, Wash.	W. A. Wicks	1.2	56°	Fair
Sharon, Pa.	C. H. Wiltsie	1.2	60°	Muddy
Shreveport, La.	W. H. Johnson	2.1	66°	Clear
Sioux City, Ia.	Thomas Murphy	1	85°	Fair
Sioux Falls, S. D.	Knapp Brown	1.2	72°	Fair
Springfield, Ill.	H. D. Parks	1	86°	Fair
Springfield, Mass.	W. F. Anderson	.5	86°	Fair
Springfield, Mo.	H. E. Seeley	.9	70°	Clear
Syracuse, N. Y.	T. A. Young	2	58°	Rain
Utica, N. Y.	W. W. Garabrant	1	58°	Bad
Walla Walla, Wash.	R. H. Tuttle	1.2	56°	Rain
Walton, N. Y.	J. R. Bryce	1.3	57°	Fair
Washington, Ia.	S. S. Smith	1.2	72°	Wet
Waterloo, Ia.	R. H. CV	1.4	69°	Clear
Wilkesbarre, Pa.	W. S. Lee	1.2	71°	Showers
Worcester, Mass.	F. B. Williams	1.1	86°	Clear
Yankton, S. D.	J. P. Nyberg	.8	70°	Clear
York, Pa.	T. S. Pfeiffer	1.2	71°	Rough
Youngstown, Ohio	J. Stuhldreher	1.3	69°	Muddy

Every car was absolutely stock, without special attachments of any kind. No extra lubrication was employed. The sworn average consumption of oil during the run was 1.2 gal. per car. Each run was witnessed and attested by disinterested observers.

Throughout the country the severest roads known to automobilists were chosen. At Colorado Springs the route led by way of Dead Man's Canyon and Ute Pass to Cripple Creek. The finish was at the top of Tenderfoot Hill, 10,500 ft. above the sea.

In Denver, Mr. F. C. Cullen four hours after he started, was 11,500 feet above sea level. The worst roads and mountains within 100 miles of Denver were traversed and the finish was at the top of Lookout Mountain. Elevation lowers the boiling point of water, but has no effect on the cooling ability of air.

At Wilkes-Barre, Pennsylvania, Mr. W. S. Lee finished a hard run by climbing Giant's Despair, the well known testing ground.

At Pittsfield, Massachusetts, the demonstration finished at the top of Jacob's Ladder.

At Springfield, Mass., at the top of Mt. Tom.

At Newburgh, N. Y., at the top of Storm King Mountain.

At Los Angeles, Cal., at the top of Wilson's Peak, 5,800 ft. above the sea.

At Kingston, N. Y., the Catskills were climbed.

Norwich, N.Y., used three gallons of oil. The reason was a broken sight feed pipe.

Pittsburgh, Pa., and Tulsa, Okla., had temporary ignition trouble which barred them, though Pittsburgh had run 95 miles.

Beaumont, Texas, did not finish, due to running out of oil, which before noticed, resulted in burning out a connecting rod bearing. It occurred near the end of the 96th mile.

This unheard of 100-mile low gear demonstration was possible because of the direct air-cooling system of the Franklin. The primary advantages of direct cooling are: (1) nothing to overheat in hard running, (2) nothing to freeze in winter, (3) the elimination of more than 100 unnecessary parts and the amount of attention necessary, (4) sheer engine efficiency and power.

With no weight of water, pump, radiator, piping, etc., the engine is not only lighter, but less weight is required in the frame, axles, and other supporting parts.

Economy Built on Light Weight

Thus comes economy. The Franklin is easy on tires, and uses little gasoline. In the National Economy Test last May, 94 stock Franklin touring cars averaged 32.8 miles on one gallon of gasoline. Tire average for four years 8000 miles.

With Franklin light weight goes flexibility—resilient instead of jarring. Franklin flexibility is obtained by a chassis frame of laminated, shock-absorbing wood instead of rigid steel, by full elliptic springs, front and rear, and by the absence of strut rods and torque bars.

Not only is the superiority of Franklin direct air-cooling absolute, but upon it, it has been possible to build a car which combines highest efficiency, economy, durability, comfort and beauty.

The Standard Light Car

The dominance of the Franklin is due to fixed principles of construction unchanged through 13 years. Always easy riding, always light and flexible, it is today recognized as the *standard light car.*

Send for the striking eight-page newspaper size, illustrated supplement, with its unusual photographs, which give a panorama of the interesting features of the runs. Also booklet of telegraphic stories by men driving the cars.

FRANKLIN AUTOMOBILE CO.
SYRACUSE, N. Y.

Weights and Prices

Touring Car,	2750 Pounds	- - -	$2150
Roadster	2610 "	- - -	2150
Coupé	2890 "	- - -	2600
Sedan	3045 "	- - -	3000
Berlin	3242 "	- - -	3200

Prices are F. O. B. Syracuse, N. Y.
Ask your dealer to weigh the car for you.

batteries. In the case of mine fields protecting the channel entrances to harbors, dockyards, etc., the fields are covered by the fire of rapid-fire batteries, conveniently located on either shore.

The Submarine Vindicated

(Concluded from page 273.)

of these instruments is known as a periscope. This consists of a vertical tube which extends from above the surface of the water to a few feet within the submarine. At the top of the tube is an object glass; at the bottom an eye-piece. Two reflecting mirrors, one at the top, the other at the bottom of the vertical tube, cause the image to be transferred from the object glass to the eye-piece. The operator can turn the periscope so as to sweep the whole horizon. To the writer, who once made a five-hour trip in one of our latest boats, the view was as clear as though he were at the surface looking through an ordinary field glass. Hence when running submerged with the top of the periscope just out of the water, the navigator can see with perfect ease surrounding objects. If for any reason it should be desired to run at a still greater depth, compasses are provided by which the course may be steered with accuracy. For steering, submerged, in the vertical plane, instruments are provided which in a way take the place of the compass. One of these is a large pressure gage, which indicates the depth at which the boat is running. Another is a form of spirit level, which indicates the inclination of her axis. By the use of this, the man controlling the horizontal rudder is able to run at a perfectly even depth. While in the submerged condition, the boat is of course amply illuminated by electric lights. There are no ports or windows in the boat, and so far as sensations are concerned, one is unable to determine whether he is running on the surface or submerged.

The arm of the submarine is the automobile torpedo. A number of these may be carried. They are discharged through torpedo tubes located in the bow of the boat. Any modern type of automobile torpedo may be used. In view of the fact that the submarine is enabled to approach unseen to within a few yards, if desired, of the most powerful battleship, a long-range torpedo is not required. For this reason the weight devoted to motive power in the ordinary torpedo may be largely used to increase the destructure power, so that the proper arm for the submarine would be far more powerful and destructive than the ordinary automobile torpedo.

How the War Affects the Papermaker

THE shutting off by the war in Europe of patented German dyestuffs and the cessation of rag importations from Mediterranean and far eastern ports may be expected to affect the quality of certain grades of colored papers. The simpler forms of paper stock and dyestuffs are poorly adapted for the manufacture of a tissue like blue seidlitz paper, which is expected to be resistant to the action of alkalies, and for this and similar grades of fast-blue paper, rags that have been dyed with natural indigo are still preferred. Paper manufacturers who specialize in colored papers of this kind are beginning to be apprehensive of trouble in maintaining supplies.

The stoppage of dye importations is likely to affect paper manufacturers in two ways. The utmost difficulty will be experienced in producing tinted papers of a quality and appearance that have become standard of late years, because these have been made with combinations of aniline derivatives that mark the extreme of invention in chemical colors, and with the paralysis of German shipping, no less than the cessation of chemical industry in Germany, where most of these new and exceptionally fast colors are produced, no supplies can be expected to reach the United States.

On the other hand, paper manufacturers will be compensated for the loss of dyestuffs of recent invention through conditions operating in another direction. The

The Dumdum Bullet

THE wide publicity given in the public press to the accusations that the various nations now in conflict in Europe have been making use of "Dumdum" bullets brings out the fact that very few people know what a "dumdum" is, and what is more to the point in the present circumstances, fewer still have any idea of the widely varying character of gunshot wounds.

During the Chitral campaign in India, in 1895, the native troops found that the nickel-jacketed lead bullets they were using were not as effective as they wished; that is, they did not "stop" their man. They found the difficulty could be overcome by partially stripping off the nickel jacket and exposing the leaden head. These bullets, because they came from the Dumdum Ammunition Works, at Calcutta, were known as "dumdums." They became greatly distorted when striking a soft body, spreading out into something like a mushroom shape and producing a very serious wound.

This is the true dumdum bullet. It will be appreciated that, as in the Indian campaign, the bullet can be easily prepared by any soldier individually, without the knowledge of his superiors; and if such bullets have been used in the present war, this is their undoubted source. In view of facts to be stated presently in relation to wounds made by modern bullets, there is little object or reason for any government intentionally supplying this form of ammunition.

For a long time hunters of big game have been aware of the deadly qualities of a bullet that would spread out or "mushroom" quickly on striking its target, and to insure this result with certainty many special devices have been introduced, such as bullets with a hollow, cup-like head, or a similar bullet combined with a plug of harder material, which, being forced into the softer lead by the impact, would quickly spread out the body of the bullet. It is evident that any soldier so disposed could, in addition to stripping the jackets from his ammunition, make a little hollow in the tip. Even a nick would have more or less effect.

But quite apart from this question is the fact that the nature of the wound would be no indication to the ordinary observer of the character of the projectile that produced it. In fact, in many cases the result might well deceive an experienced practitioner, for the modern bullet is capable of producing many entirely unexpected results.

Under many conditions, when the high-speed, small-caliber bullet used in modern rifles strikes a man, it makes an exceedingly small puncture, and passes through both bone and tissue alike, with trifling injury. Although the man is incapacitated for the time being, he suffers no permanent injury. This is what was aimed at when the small caliber rifle was adopted. Unfortunately, the bullet does not always act in this way, for the so-called "Spitz" bullet, which has been introduced in Germany and adopted by several other countries, behaves in a most

dyers of linen and cotton fabrics, the rags of which are so extensively used in the manufacture of the finer grades of bond, ledger, and writing papers, will be compelled to fall back on simpler dyestuffs of less enduring tints. Owing to the increasing use of the more complex and permanent dye compounds, papermakers have found it impossible to use a great variety of rags that was once available. The reason is that nearly all of the finer qualities of modern shirt material, skirtings, etc., are dyed with coal tar dyes, which are exceedingly resistant to bleaching agents. It will be readily understood, therefore, that any extended interruption of supplies of these dyestuffs is likely to cut two ways. It would hamper the papermaker in producing colored papers of a brilliancy and permanency that have become popular of late years, but it would, at the same time, open up to him plentiful sources of rag supplies that could be easily treated to yield fine white paper pulp.

uncertain manner. Being quite short and conical and with a gradual taper, the center of gravity is thrown back near the base. Consequently, it is very liable to be disturbed in its flight, when it turns sideways. Instead of making the small, clean-cut perforation expected, it tears its way through the tissues, making a terribly lacerated wound very similar to that which would be produced by a dumdum.

Another kind of wound which is not infrequent is the one that appears to have been made by an explosive bullet, but is only another effect of the high velocity bullet, which is well known but probably not thoroughly understood. One explanation is that by its tremendously rapid translation both through the gun barrel and the air, the bullet is set in vibration, and the effects it will have upon the tissue of the human living body will be relative to the capability or incapacity of the tissues to take up and transmit the vibration or wave motion. This can be better understood from an experiment made in studying the subject. A tomato can was filled with water and the bullet fired through it. The entrance hole was small and almost as if cut out by a punch, and the edges but slightly inverted, while the exit hole was an inch and one half across and very irregular. Moreover, the front end was badly bulged out, the rear end torn nearly loose, and the sides partially collapsed. The indications were that the pressure or forces acted after the bullet had passed through the can and as a vibration or wave would act.

Many wounds of the character above noted have been observed in the past, and it is evident that the apparently small and humanitarian bullet, now almost universally used in warfare, has not only largely failed in its object, but has been the cause of decided but unmerited suspicion in several quarters; and while it is likely that some of the soldiers have manufactured their own dumdums, it is more than probable that the specimens alleged to have been found and the packages of such ammunition were in the possession of non-combatants who had the cartridges for sporting purposes.

British Patents and the War

THE "revocation" of British patents granted to German and Austrian subjects has aroused in many fair-minded people a feeling that the British government has gone to great extremes to punish subjects of the powers with whom it is at war. But a careful investigation of all the facts prompts one to believe that the first thought in the enactment of the law which has created so much resentment has not been to deprive the Germans and Austrians of their patent rights in Great Britain, but to prevent an interruption in those industries which are carried on wholly or partially under patents owned in Germany and Austria.

The statute amending the British Patent Act under which the patent rights of subjects whose countries are at war with Great Britain may be interfered with, provides for the "avoidance or suspension in whole or in part of the patent or the license granted." Under the rules provided by the Board of Trade for carrying out the provision of the statute, a patent owned by a German or Austrian subject can be interfered with only by making application for the "avoidance or suspension" of the patent. When such an application is made, the Board of Trade will decide to what extent property rights in the patent in question must be interfered with to permit the continuation of manufacture under conditions as normal as possible. But, in addition, the Board of Trade will determine whether the applicant must pay a license fee for the right to use the patent. While the word "avoidance" in the statute means the annulment of the patent, it is not believed that many patents will be annuled under the statutory provisions, for in most, if not in all cases, the suspension of the patent or the grant of a license should satisfy the needs of British manufacturers. Before arriving at a decision as to what action is to be taken on an application, the Board of Trade will undoubtedly consider whether it will be necessary to invest a considerable amount of capital to manufacture under the patent, in a commercial manner, and whether it will be necessary to grant rights for a considerable term in order to interest sufficient capital to undertake the enterprise.

The probabilities are that all license fees will be collected by the Board of Trade to be retained until the termination of the war.

The Current Supplement

IN the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2022, for October 3rd, will be found an interesting account of the use of searchlights for war purposes, especially as developed in France. An unusually valuable article to those interested in the manufacture of iron, and the facts given in which are also undoubtedly applicable to a considerable extent in other lines, is Electric Driving for Rolling Mills, which gives facts and figures as to the application of the system to mills now using steam drive, and shows remarkable economies in both cost and space. Recent Developments in Marine Propulsion reviews the history of the turbine, and tells how it is now applied to secure both economy and efficiency, and also has something to say about the Diesel oil engine. The history of the Automobile Torpedo will interest everyone in view of the recent sensational use of this comparatively little known war engine. The problem of controlling big ocean steamships is always a vital one, and the description of the Westinghouse Bridge Control indicates a wonderful advance. By means of a comparatively simple combination of devices, operated by compressed air and oil under pressure the officer on the bridge is enabled to start, reverse, or stop the turbines which drive the vessel, and to regulate their speed, as occasion requires. It is a most ingenious and valuable device which has proved its efficiency in practical tests on the U. S. collier "Neptune." The Experimental Plotting of Electro-Static Fields covers a subject which is explained by its title, and has a practical as well as an experimental interest. Wireless Equipment of Aircraft describes in simple language that can be understood by anyone how wireless messages are sent, and tells of the difficulties of operating to and from aircraft. Birds and the weather discusses theories connected with the migration of birds. A review of a new atlas of Finland gives much interesting information about an attractive country of which we know but little. The address on Heredity, by Prof. Bateson, is concluded in this issue; and there is the usual assortment of smaller but valuable articles.

Salt and Microbes

SALT is generally thought to be fatal to microbes, because it serves to keep perishable food substances, but from an absolute standpoint, this is quite an error. For instance, the typhus bacilli, that of "rouget" of the pig, or of tuberculosis, can be placed for several weeks in brine, and thrive all the better. Besides, it should be remarked that blood contains salt, and this does not prevent microbes from multiplying upon proper occasions. Certain changes seen in salt fish, for instance, in codfish, come directly from microbes brought by the salt itself. For, in fact, the salt as it is prepared in the salt marshes is far from being sterile, and Dr. Rappin of the Nantes Pasteur Institute was able to count no less than 30,000 bacteria per cubic centimeter in the concentrated brine from which the salt is deposited. After the salt is placed in piles, it undergoes numerous grindings in which hygiene is entirely lost sight of. Thus he finds that far from being antiseptic, salt of that kind, and no doubt from other sources, needs to be put through an antiseptic treatment. Such could be done by a strong heat in a closed vessel, or by washing it with a hypochlorite of soda solution. Unfortunately, such operations would be difficult to carry out in practice.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Aviation.

COMBINATION AEROPLANE AND DIRIGIBLE BALLOON.—A. E. MUELLER, Los Angeles, Cal. This aeroplane is fish-shaped as viewed from above, consisting of a main plane of oval form, and an auxiliary plane fore and aft. Above the main plane is a rectangular plane. The main plane and the rectangular plane are provided with panels capable of being tilted as desired, to provide stability. The fore-and-aft planes are also movable, for the purpose of stabilizing and steering the aeroplane. The machine is provided with a propeller fore and aft, also a series of bladed wheels with their upper halves housed so that they will operate to propel the aeroplane on the principle of the paddle wheel. Provision is made for combining with this machine an elongated balloon.

Electrical Devices.

TESTING LAMP AND FUSE TESTING DEVICE.—C. W. MITCHELL, 513 Twelfth St., Brooklyn, N. Y. This invention has for its object the provision of an improved testing construction which may be adjusted or rearranged to accommodate varying circumstances, and for testing conductors of electric circuits under varying conditions. It may be used at one time in series with a circuit and at another time in multiple series.

WIRE REEL.—W. E. EICHHOFF, care Mary E. Eichhoff, Azusa, Cal. This improvement is more particularly for use by the linemen of telephone, telegraph, and electric light companies, in which ample strength is required to support the weight of heavy coils of wire, especially when the reel is so disposed as to turn on an approximately horizontal axis for reeling or taking up the wire.

Of Interest to Farmers.

HARROW.—O. L. MCKINLEY, care of McKinley Bros., Demopolis, Ala. The present invention refers more particularly to sectional harrows, the object being to provide a sectional harrow in which each section is so constructed that a plurality thereof may be selectively assembled without regard to rights or lefts, or fronts or rears.

CULTIVATOR TOOTH.—R. E. MCCULLEY, W. G. REA, and D. B. FORWARD, Cedarville, Modoc Co., Cal. Among the objects here is to provide a cultivator tooth of peculiar construction and adaptation, the same being detachably connected to a cultivator post in such a manner as to be capable of reversal from one end to the other, whereby the efficiency of the tooth is increased.

SEED GRADING MACHINE.—E. W. VAN FLEET, Evart, Mich. The purpose of this invention is to provide a simple, cheaply constructed, and easily operated machine, especially designed to separate seeds into different sizes and to polish and clean the said seeds during the separation of the same into their respective grades.

Of General Interest.

GUTTER HANGER.—C. W. WHEDON, care of Archer & Whedon, Medina, N. Y. The invention relates to gutter hangers or supports, the more particular purpose being to provide a gutter hanger and gutter to be supported thereby, these parts being of such form that the gutter when mounted in position upon a building has the appearance of a cornice, and is otherwise ornamental.

EGG CARRIER.—I. V. BOWLEY, 19 Friend St., Taunton, Mass. This invention relates to packing or shipping receptacles and has particular reference to partitions or fillers for receptacles intended for the transportation of eggs, bottles, electric light bulbs, or other fragile articles. Among the objects is to provide a filler of a simple, cheap, and reliable nature.

WIRE HOLDER.—S. E. ELLIOTT, West Salem, Ill. This device is especially adapted for holding wire fencing during the stretching thereof, and wherein means is provided for permitting the clamping bars that engage the fencing throughout its height, to be easily and quickly placed on the fence or to be removed therefrom, without the necessity of removing or replacing taps, nuts, and the like.

WIRE FENCE CLAMP.—E. B. WELLS, 135 Eleventh St., Miami, Fla. This clamp is utilized to clamp wire fencing, for attachment with any suitable device whereby the fencing may be pulled tightly along and against the posts in erecting a fence, and the aim is to provide a device which comprises quick detachable members for disposal on opposite sides of the wire fencing and for connection therethrough.

HOLDER FOR AN INSECTICIDE.—M. MCKAY, care of Fore & Co., Inc., Roxobel, N. C. In carrying out this invention, Mr. McKay preferably employs two receptacles, or bags, which are constructed of fabric that is permeable to the powder, the inner bag having a coarser mesh than the outer one. And he provides the inner bag with an elastic or spring distender adapted to prevent the bag's collapsing in consequence of the discharge of a large portion of the insecticide powder.

FRUIT STAND.—O. ROBERTS, Bonham, Tex. This invention is an improvement in fruit

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GERMAN CHEMIST, SPECIALIST in manufacture of synthetic Cumarine and Aubepine, wishes to get into communication with parties interested in manufacture of these articles in U. S. A. Address, Richard Thurm, Union Bay, B. C. Canada.

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stands, and has for its object to provide a stand of the character specified, in the form of a receptable for holding fruit, so arranged that while the fruit may be freely inspected, it cannot be removed from the receptacle without opening the same.

HORSE COLLAR PAD.—D. L. WILLIAMS, care of Ord, Nebraska Valley Co., Ord, Neb. By means of the pad the collar opening may be varied in size to fit the necks of different horses. The aim of the invention is to provide an inexpensive, simple, and efficient pad for a closed horse collar whereby the same can be adjusted to fit the necks of different horses.

PHOTOGRAPHIC CAMERA.—A. VORIS, 15 Cottage St., Jersey City, N. J. This invention relates more particularly to that style of camera in which the image formed by the lens is focused upon a screen at the front of the plate-holder and is observed by the operator through a suitably located aperture in the camera box.

PULLEY AND LOCK FOR CABLES.—A. J. HAGAN, 869 Ninth Ave., New York, N. Y. This invention relates particularly to a pulley and lock for clothes lines. The object is to provide a structure in which the clothes line will be properly held in position and locked against movement when the line is slack, but will be permitted a free movement over the pulley when the line is taut.

AGITATOR AND FILTER FOR TREATING ORES.—J. D. FIELDS, Maxville, Mont. An object here is to provide an apparatus which may be used for the leaching of ores or bringing their metallic content into solution with the use of acid, corroding gases, or corroding alkalis without necessitating any alteration of the apparatus.

BRUSH.—J. MORRISON, JR., 2½ Gage Ave., Glens Falls, N. Y. The invention relates to improvements in brushes, and the object is to provide an improved structure which is adapted to properly fit the hand so as to be readily retained in the grasp. Another object is to provide a brush with a light and substantially waterproof back.

MANUFACTURE OF INDUSTRIAL OBJECTS FROM VOLCANIC OR OTHER FUSIBLE ROCK.—F. RIBBE, 26 Avenue de la Gare, Mauriac, Cantal, France. This process is distinguished from previous processes for the manufacture of articles from volcanic rocks or other minerals by melting and molding said rocks or minerals, the distinction being due to the fact that the rocks or minerals are, after fusion and molding, but before their temperature falls below 500 deg. Cent., placed in a reheating furnace, heated to about 800 deg. Cent., and remain at this from half an hour to an hour and a half, according to size, and are then cooled very gradually.

HOT WATER DISPENSER AND DRINKING GLASS STERILIZER.—J. I. OLLIVETTI, Plattsburg, N. Y. This invention is especially adapted for use in bar rooms, restaurants, drug stores and like places, where drinks are sold to the public, whereby the glasses or other drinking vessels can be easily, quickly, and effectively sterilized and hot water dispensed where such is necessary for the preparation of hot drinks.

DISPLAY COUNTER.—E. FRIEDRICH, 802 E. Commerce St., San Antonio, Tex. This invention relates particularly to grocery counters having a series of drawers at the back thereof, and more especially to a novel form of sample containers, and means for supporting and removably retaining the sample containers at the front of the counter.

RING SETTING.—HATTIE A. DAVIDSON, care of John J. Smith, 71 Wall St., New York, N. Y. This invention relates to jewelry, and particularly to a combination ring setting and locket or lavalliére, and has for an object to provide an improved setting which may be quickly and easily applied to a removable ring and also quickly removed from a supporting chain.

SUSPENSION ROOF.—C. BUTLER, 1170 Broadway, New York, N. Y. This roof is designed to inclose areas large enough to accommodate circuses, fairs, field meets, baseball, football or other athletic games, whereby such events may be held in all kinds of weather or at night by the provision of suitable lighting facilities which may be supported from the roof.

PRINTING FRAME.—H. COHN, 2110 Hughes Ave., Bronx, N. Y., N. Y. This invention provides a frame having upper and lower frame members, hinged at one end, there being a spring for raising a glass member relatively to the lower frame member, so that a print may be conveniently slid off the glass, the glass being normally held down, and in the lower frame member by back members and clamps on the upper frame members. These back members are prevented from falling through the upper frame member by the hinges, which extend laterally and are adapted to rest on an inner flange on the upper frame member.

HAND PUMP.—A. C. STIEFEL, Houma, La. The purpose here is to provide a pump for use in transferring liquid from one receptacle to another, or for bailing out boats and the like, wherein a light, compact, and easily transported device is provided, capable of being held in one hand and operated by the other, or in any other suitable manner.

MOLD FOR FENCE POSTS.—E. P. BAUM, Box 51, Keokuk, Iowa. In this invention the improvement has reference to a mold formed in sections and having novel co-acting members on the sections, to hold in place wire-holding

elements during the molding process, to incorporate said elements in the molded post.

METHOD OF PREPARING LITHOGRAPHIC STONES.—H. BUSCH and W. SCHUPBACH, care of the former, 155 Napen Ave., Woodhaven, N. Y. This invention provides means for registering a tinting screen of the "Ben Day" type upon successive stones employed in lithography; provides means for avoiding the production of "patterns" when using a tinting screen in lithography; and reduces the expert-labor factor in preparing stones for lithographic printing.

Hardware and Tools.

TENT PEG.—W. G. STEADMAN, JR., U. S. N. Recruiting Station, 161 Griswold St., Detroit, Mich. This invention provides a peg having means for anchoring the same in the ground, thereby preventing the withdrawal of the peg until such time as it is desired. In this peg the anchoring means may be withdrawn into the peg, thereby permitting the peg to be readily pulled up.

GRASS TRIMMER.—C. NYSTROM, 1629 Plymouth St., Westchester, Bronx, N. Y. This invention provides an arrangement of relatively reciprocating cutters, whereby the cutting edges will be maintained in contact so that the grass will be effectively cut without liability of the cutter becoming choked, the operating mechanism for the movable cutter or blade including means whereby the blades are maintained in cutting contact.

TOOL HOLDER.—J. H. FRANZ, 144 Clinton Ave., Brooklyn, N. Y. An object in this case is to provide a device for holding tools in the most advantageous and practical positions. And further to provide a device in which the removal or replacement of a tool for resharpening or for other purposes is greatly facilitated.

SPACER BOLT.—G. COUSINS, 75 Ellen St., Oswego, N. Y. By means of this bolt, walls, as for instance the walls for concrete forms, may be held in spaced relations by means of a single bolt, which engages both walls positively, and firmly holds the two walls from lateral movement toward or from each other. It is so arranged that the bolt may be applied and moved, in a minimum of time and with a minimum of labor.

Heating and Lighting.

OPERATING MEANS FOR ELECTRIC LAMP SWITCHES.—A. J. TIZLEY, care of E. F. Caldwell & Co., 38 W. 15th St., New York, N. Y. This inventor provides a rotary lamp switch member with a stud movable in a slot in a casing by a cam mounted on a collar so that the switch member may be rotated a distance by the collar and the cam, and with a further rotary movement of the collar the cam may push the stud into a recess at the slot, which permits the cam to pass the stud. The switch member may be then moved back to normal position by a spring. The rotary switch member having the stud may be connected with an electric switch of a well-known type.

Household Utilities.

STOVE.—C. A. WILKINSON, 39 King St., Worcester, Mass. This invention relates particularly to family gas ranges for ovens, and what is known as bakers' ovens, and has for an object a construction whereby the heat is retained and more evenly distributed. The stove is formed with an oven having a top and bottom construction of reinforced concrete.

VACUUM PRODUCING APPARATUS.—F. A. WEIMANN, care of Fischer, Sweeney & Brough Co., 1302 Clinton St., Hoboken, N. J. This improvement provides an apparatus more especially designed for use in vacuum cleaning systems and arranged to readily draw air and dust through the house pipe to slime the dust and separate the air from the slimed dust, and to permit of using the water for sliming the dust over and over again.

WALL HEATER.—G. F. REZNOR, care of Reznor Mfg. Co., Mercer, Pa. This invention more particularly relates to gas heaters of the type known as wall-heaters, and is especially intended for use in bathrooms. It provides a heater the body and frame of which will be kept below a temperature at all liable to set fire to the walls in which the heater is installed.

BED.—T. H. SORLIEN, 116 Eighth St., So. Minneapolis, Minn. This invention relates to a bed that may be raised into a ceiling opening, and it provides a sprocket chain connection between the crankshaft and the upper side wall shaft in order to do away with the vertical side wall shaft, and also provides a structure around the ceiling opening and co-operating with the false ceiling part, whereby to at once conceal the latter from observation when the bed is lowered and permit of its vertical movement without the necessity for the use of limiting chains.

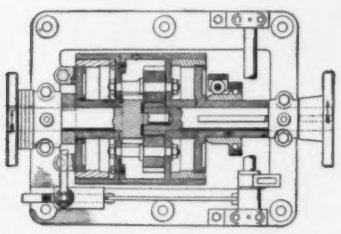
Machines and Mechanical Devices.

GUIDE FOR SEWING MACHINES.—T. F. DENNISON, 61 Central Ave., Passaic, N. J. The guide is mounted on the bench opposite the feeding side of the machine for guiding the piece of goods to the hemmer of the machine, the guide being arranged to permit of moving it away from the feeding side of the machine to allow convenient access to the machine for removing the machine from the bench for repairs or other purposes.

PNEUMATIC PUMP.—A. J. HUBBARD and C. SWANSON. Address Hubbard & Schmiedes-

kamp, Rooms 13-15 Stein Bldg., Jacksonville, Ill. The object of this invention is to provide a construction which will do away with all packed joints, springs and diaphragms, and also do away with all valved or mechanical parts exposed to the weather. A specific object is to provide a piston which is acted upon by the compressed air and which may effectively operate without the use of the usual cup leathers.

BRAKING DEVICE FOR REVERSIBLE GEAR MECHANISM.—F. J. ROBINSON, 44 W. Tyler St., Hampton, Va. An object here is to provide a braking mechanism for reversing gears in which a spring ring is so disposed with relation to a drum that the ring may be



BRAKING DEVICE FOR REVERSIBLE GEAR MECHANISM.

brought into contact with the drum at all points on its periphery when actuated and when free from the drum it may spring entirely away from the drum.

ROPE RAILWAY.—T. THUNHART, Rosseggerstrasse 10, Leoben, Styria, Austria-Hungary. Carrying ropes form two groups side by side whereon the trolley carrying the car runs, the car, being suspended between the groups. Means support a guide rail which projects above the ropes and raises the car from, and permits longitudinal displacement of the same. On the standards freely rotatable grooved rings guide the carrying ropes and are themselves guided on the standards by rollers. Means provide that if one carrying rope breaks the corresponding rope of the other group is simultaneously untensioned while the remaining ropes remain tensioned. In addition to the traction rope which is detachably connected with the car, is a second which connects the cars together and at the stations alone conveys the cars, released from the former traction rope, from the incoming onto the outgoing track.

Pertaining to Vehicles.

AUTOMATIC OIL INDICATOR AND FEEDER.—C. E. HENKELMAN, 2213 Pacific Ave., Atlantic City, N. J. In carrying out this invention, Mr. Henkelman avoids several objections by providing an indicator and feeder, wherein the operator will be informed at all times of the quantity of oil in the motor, simply by inspection of an indicator located at the dashboard, in which, when the oil recedes to a predetermined level, oil will be automatically supplied from a reserve tank and the supply cut off upon the oil's reaching such level.

SUPPLEMENTAL TIRE.—L. ZEMAN, Tobias, Neb. This invention relates to supplemental tires for wheels of wagons or other vehicles except such as run on rails or are equipped with pneumatic tires. The tire may be readily attached to or removed from the wheel and is provided with a calk for preventing the skidding of the vehicle on slippery roads.

GARDEN TRUCK-BURNER BARROW.—T. TRAVIS, Groton, Long Point, Conn. This barrow can be readily wheeled about and used either for carting purposes or for burning garden truck at any point in the garden without danger of setting fire to surrounding objects and at the same time avoiding tedious carting of the truck to a separate burner at a distant point.

Designs.

DESIGN FOR A BROILER GRIDDLE.—S. BINSWANGER. Address Ross Boiler Co., 111 South 3rd St., St. Joseph, Mo.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

THE ORIGIN OF THE CHEMICAL ELEMENTS AND OF CELL LIFE. By Clara E. Speight-Humberston. Acton, Ontario: The Acton Free Press, 1914. 8vo.; 60 pp.; with plates.

We are given in this slim volume some interesting speculations based upon the researches of Lowig, Lodge, and other investigators, supplemented by the author's own studies. We fail, she holds, to understand the construction of the cell-wall, because we ignore the intervening substance between the nucleus and the wall. The origin of living cells, she maintains, must be looked for "at the place of decomposition and reconstruction of electric charges into primal ether, this ether taking the place of exhalation and inhalation, or the breath of life"; and the basis of vital processes is "the fixed combination of different kinds of electric charges, making up a definite number of atoms, all containing the same weight, but representing different positions in space, because of different degrees of expansion, or conditions of 'tension.'" It is a work difficult to appraise and impossible of summarization in a short review.

THE SCIENCE OF BILLIARDS. With Practical Applications. By J. T. Stoddard. Boston: W. A. Butterfield, 1913. 8vo.; 160 pp.; with diagrams. Price, $1.50 net.

Billiards, a game so essentially dependent upon science and skill, is worthy of wider interest and interpretation than has hitherto been accorded it. The volume in hand is a welcome addition to the scant literature of the game, and imparts a very clear knowledge of the complicated factors entering into the play. The behavior of the balls under the different shots—center, follow, draw, side, piqué, and massé strokes—is analyzed in a masterly manner, and both student and practised player may profit by the principles imparted and the additional control thereby gained.

STEAM TURBINES. A Practical and Theoretical Treatise for Engineers and Designers. Including a Discussion of the Gas Turbine. By James Ambrose Moyer, S.B., A.M. New York: John Wiley & Sons, Inc., 1914. 8vo.; 376 pp.; illustrated. Price, $3.50 net.

Steam turbine development of the past few years is notable for size increase, and is marked by a tendency to restrict usage to three or four types. Only three years ago the largest turbine-generator was rated at 14,000 kilowatts; to-day we have the 35,000-kilowatt generator. Prof. Moyer's work in this, its second edition, has been considerably extended and improved. Among new material we find discussions of bleeder or extraction turbines and mixed pressure turbines. Other additions are evident in the chapter on low-pressure turbines, as also in many others. New calculations have been made, and the result is an entropy-heat chart embodying the very latest data on superheated and saturated steam. The gas turbine is touched upon, and the difficulties attending its practical development are briefly sketched. An appendix contains examples relating to steam turbines, which are to be worked out by the student.

MODERNE PROBLEME DER PHYSIK. Vortraege von Dr. H. Sieveking, A.O. Professor an der technischen Hochschule Karlsruhe. Braunschweig: Friedrich Vieweg und Sohn.

The Mannheim Section of the Verein Deutscher Chemiker decided in 1913 to inaugurate a series of lectures for the purpose of instructing its members in the more recent achievements in theoretical chemistry and physics, with special reference to the later work which has been done in electricity. In five lectures Dr. Sieveking gave the Mannheim chemists a very complete review of the work which has been done within recent years. This book is a republication of these five lectures. Written in a fairly popular style, they ought to be highly instructive to those interested in science and who wish to keep abreast of the times. They discuss in a very instructive way modern electronic theories, radio-activity, progress in thermo-dynamics, Roentgen rays, electro-dynamics, as well as the principle of relativity.

MANUEL PRATIQUE DE FONDERIE. Cuivre. Bronze. Aluminium. Alliages Divers. Par J. Duponchelle, Ancien Directeur de Fonderie. Paris: H. Dunod et E. Pinat, 1914. 8vo.; 258 pp.; illustrated. 6 francs.

French foundry practice is herein set forth somewhat exhaustively. The text is replete with illustrations of installments, utensils, and machines and accessories of every description. Useful forms and tables and a fairly good index go to the completion of a handbook that will appeal generally to owners, managers, and students who have a reading acquaintance with the French language.

A POCKET MAP OF THE RIVER THAMES, FROM OXFORD TO RICHMOND. Showing the Towns, Bridges, Locks, Towpaths, Ferries, etc. With Distances from Oxford. London: The Homeland Association, Ltd. 16mo. Price, 1s. net.

A dainty little frontispiece shows the lock at Mapledurham. The sectional maps are on a scale of one inch to the statute mile. There are hints and rules for river conduct and brief descriptions of the points of interest.

Notes and Queries

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(13023) H. Z. asks: Kindly let me know through your magazine the distance round the earth six miles above the equator, if possible; if not, the length of the equator. A. The equatorial radius of the earth used by astronomers in their calculations is 3,963,296 miles, or 20,926,202 feet. With this number you can find the circumference of the earth six miles from the equator. We are not able to give the time for the solution of mathematical problems for our esteemed correspondents. The radius of the circle of the parallel of latitude six miles from the equator would be about 24 feet shorter than the radius at the equator. If you would find it more exactly, you must employ trigonometry.

(13024) E. E. S. writes: An unusual combination of natural phenomena occurred shortly after 4 o'clock yesterday morning (July 8th). The sun was just rising while the moon was still visible in the west, a thunder storm was in progress, and a rainbow was also clearly visible in the sky. The sky was wonderful! The rainbow was south-southwest, with the black storm cloud rising behind it, while in the east the sky was golden, suffused with pink, from horizon to zenith. The preceding day had been the hottest of the year. Now I want to thank you for your sky maps. With their help I have learned to know all the first magnitude stars and have followed the constellations on their way from east to west for a year, and feel that I have a bowing acquaintance with Mars, Saturn, Venus and Jupiter. As I am forty-five years past the latter end of my school days, I feel quite "sot up" with my attainment. A. It is quite unusual to see such a combination of natural phenomena at so early an hour. Most people are abed at that time. It is pleasant to receive so hearty a testimonial of benefits received from our columns.

(13025) R. W. asks: 1. Is it a recognized law of meteorology, or is it simply due to chance, that local showers seem to follow in the same path some seasons, and to avoid places where there had not been rain for some time? It seems that some parts of a country, for instance, will have three or four good rains, while a strip of country five or ten miles away will have light rains or none at all. Have scientific observers ever noticed this apparent tendency of rains to follow the same path for some time? A. The occurrence of several seasons in succession with similar weather, as wet or dry, cold or warm, has been noticed by meteorologists, but no law to explain the fact has been detected. 2. Also, do small lakes receive more rainfall than the surrounding country, on the average? A. It is not probable that more rain falls on a small lake than on the land surrounding the lake. We see no reason why such should be the case.

(13026) E. C. L. M. asks: In connection with the letters and discussion on scientific writing and scientific terms, I wish to call your attention to a question and answer in the question column of a periodical. Question: "Can you say 'the flying machine is afield' when it is in the air?" Answer: "If an aeroplane were on the practice ground, it should be characterized as being afield, but if it were in the air, it should be characterized as being afloat, that is, as floating in the air." Afloat is evidently not the term to use, as an aeroplane does not float. What would be a better term? A. We should not object to the use of the word "field" as describing the region in which an aeroplane is moving. As well object to the use of "flying," since these machines glide rather than fly. We think it was Longfellow, in a poem beginning "How beautiful the rain!" who used the expression "fields of air," and represents Aquarius as flying through the fields of air. We agree with you that aeroplanes do not float. They are far from being floating machines.

(13027) D. F. B. writes: In the answer to question 12988, in the issue of May 2nd, 1914, you state: "A vertical line is one which passes from the center of the earth to the zenith of any place." While the conclusion of your explanation answers the question correctly, the statement quoted above is not correct. The earth being an ellipsoid, or very nearly so, a vertical line is tangent to the evolute of the generating ellipse, and does not touch the center unless it is drawn through a point on the equator or through the poles. A. You are quite correct in your criticism of the answer to Query 12988, but the difference is, we dare say, not perceptible to the naked eye. It would have been better for the purpose of the inquirer to have said the line passing from the zenith through the observer. Then the critic would have said that the observer is thicker than a line. This question came, as we remember it, from two workingmen who were having a discussion and asked our decision. How much could they have made out of the definition that a vertical line is tangent to the evolute of the generating ellipse of the ellipsoid of the earth's surface? If, as many astronomers believe, the equator is not a circle, then the earth is not an ellipsoid of revolution, and what is the definition of a vertical line then? Sometimes it is easier not to be too technical.

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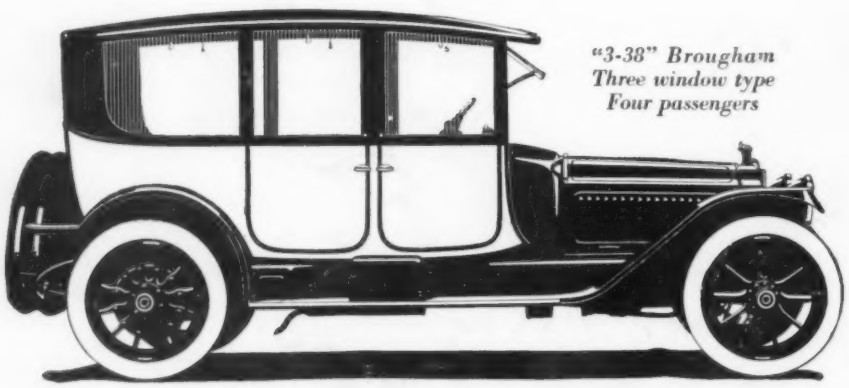

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